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ABSTRACT

This activity notebook for grade 6 is one of a series developed in response to the concern for energy conservation. It contains activities that stress an energy conservation ethic and includes many values clarification activities for grade six. The packet is divided into two parts and provides the teacher with background information, concepts and objectives, and activities for each part. Part one is concerned with the limits of energy sources and part two with alternative energy sources. Both sections include energy conservation activities. Two annotated bibliographies, one for teachers and the other for students, are also included. The teacher is provided with ditto and transparency master pages for duplication. An evaluation sheet and a listing of resources are also a part of this activity packet. Revisions include updated background information and statistics, three additional solar and conservation activities plus a revised bibliography. (Author)

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ENERGY

Conservation Activity Packet

Grade 6

Sponsored by:

Iowa Energy Policy Council

and the Iowa Energy Extension Service

in cooperation with

Iowa Department of Public Instruction

Revised-1980

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ENERGY CONSERVATION ACTIVITY PACKETS

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The energy shortages and emergencies with which we are faced attest the treatment humans have given to their natural surroundings. Not only do we experience personal inconveniences, but we also see severe economic and environmental consequences. Our nation has arrived at a time when it needs to reevaluate where it is going, at what speed, and how it will eventually arrive at that goal. The National Academy of Sciences generally agrees that the reserves and resources of domestic oil, gas and coal will satisfy energy needs in the United States until the year 2000. Presently the United States doubles its energy consumption every 13 years. In 1975, electric companies burned 507 million barrels of oil to generate electricity, 500 million barrels were burned to heat factories. Much of the oil and natural gas consumed could be replaced by coal, thus drastically reducing oil imports.

The instructional program in a school can examine this energy situation with reason and logic. When a social issue is integrated into the total curriculum, it helps children to apply what they are learning. The educational process can help students become aware of the alternatives and consequences in regard to energy, then guide them to choose a value. Students can learn that it is just as exciting to make something last as it is to develop something new.

Through use of the enclosed materials and activities, it is our intent to stress a conservation ethic. The conservation ethic means more than turning lights off; it has wider implications such as developing new industries to recycle metals, making more durable products, and prioritizing fuel uses.

Our values show what we tend to do with our limited time and energy. They are related to the experiences that shape them. In order to help children develop clearer values, teachers must help them use the process of valuing.

Choosing	(1)	freely
	(2)	from alternatives
	(3)	after thoughtful consideration of the consequences of each alternative
Prizing	(4)	being happy with the choice
	(5)	willing to publicly affirm the choice
Acting	(6)	doing something with the choice
	(7)	repeatedly, incorporating in some pattern of life

Students become much more purposeful when they have been given opportunities to clarify their values.

Each packet contains values clarification exercises designed to carry out the stated objectives. The teacher may wish to use a specific model to

develop more exercises. You will find that the valuing process is another tool for the teacher. When used, it leads children from apathy and confusion toward positive learning and life-styles.

The goal of providing the types of activities, which have been included, is to create a growing awareness for the need of dealing with existing energy problems in a positive way. Individual teachers should select objectives which they feel reflect the needs of a particular class. Each packet contains an energy goal and an awareness or accommodation objective. It is imperative to include objectives from each conceptual area as the purpose of these packets is to develop an energy conservation ethic within the students of today that they may become conserving and concerned citizens of tomorrow. Changes may not occur immediately due to home and parental values; however, as they become adults, this learning will show its effects.

Each packet includes many activities for the teaching towards the stated objectives. Teachers need choose only those activities which they feel will accomplish their objectives. As there are often many activities suggested for an objective, the teacher may choose to prepare and offer multiple activities. This could allow students to choose the activity they find most interesting. The teaching of energy and its conservation is designed to be interdisciplinary in order that students see that energy cannot be isolated from our daily lives. This is also important in developing the conservation ethic.

Within the packet, teachers will find transparencies, posters, filmstrips, etc. which may add to the teaching of energy and development of conservation. (These supplementary sheets are grouped together at the end of the notebook behind the colored divider page.) These visual materials plus the activity sheets can be adapted for many uses beyond those suggested, even though a variety of presentation methods is inherent in the notebooks. For example, class, small group, individual, and even family activities are included. In fact, each packet has at least one student interest center or learning station sheets included in the supplementary sheet section. Suggestions and criticisms from teachers, consultants, etc. would be appreciated and considered in keeping these packets suitable for the majority of school systems.

Most young children (7-11) years are in the concrete operational stage as named by Piaget. Such students consider real, concrete things in a systematic, but not abstract manner. Therefore, the activities which have been proposed reflect this and provide for greater awareness, rather than a formal study of energy. Individual teachers know their students best and will need to select items which they feel will be of greatest benefit to the education of the children. This is also the reason the concepts and objectives for the primary grades (K-2) have been combined in one packet. There are some classroom activities which require about 20 minutes each, some 40 minutes, and there are also some activities which can be done at home in order to enable children to work with their families.

AN OVERVIEW OF THE CONCEPTUAL DEVELOPMENT OF
K-6 ENERGY PACKETS AT A GLANCE

ENERGY GOALS

K-2 The learner becomes aware that all living things require energy.

The student becomes aware of sources of energy within the learner's home and school.

The learner becomes aware of uses of energy.

Grade 3 The learner develops an understanding of how energy affects our lives. (Packet A, Goal 1.00)

The learner examines the available energy sources. (Packet B, Goal 1.00)

Grade 4 The learner becomes aware that energy can be changed from one form to another - conversion. (Packet A, Goal 1.00)

The learner considers energy, its production, use, and conservation as essential in the maintenance of our society as we know it. (Packet B, Goal 1.00)

Grade 5 The learner develops an understanding of fossil fuels and uses. (Packet A, Goal 1.00)

The learner recognizes the involvement of energy in Iowa's past, present, and future. (Packet B, Goal 1.00)

Grade 6 The learner recognizes limits of energy sources. (Packet A, Goal 1.00)

The learner develops an understanding of alternative sources of energy. (Packet B, Goal 1.00)

Personal Awareness or Accommodation Goal

All packets focus on encouraging the development of a conservation ethic. The Personal Awareness or Accomodation Goals are "Goal 4.00" in the white K-2 notebook and "Goal 2.00" in both packets, A and B, within the 3, 4, 5 and 6 grade level notebooks. Activities in this section encourage students to question the personal importance and implications of that which has been experienced. They utilize the values clarification approach described by Raths, Harmin, and Simon in Values and Teaching.

ENERGY CONSERVATION ACTIVITY PACKETS

GRADE 6

PACKET "A"

TEACHER BACKGROUND MATERIAL
Grade 6 - Packet "A"

As the years pass by, people not only are using more energy but there are more people using energy. In 1900 in the U.S. there were 75 million people and they each used 100 million Btu's of energy. Seventy-five years later, the population increased to 211 million Btu's of energy. Based on population growth, consumption, and geological speculations, the U.S. can estimate how long our supply of fossil fuels will last. For instance, coal, the most abundant fossil fuel in the U.S., could last about 500 years at our present rate of consumption. This would not be the case, however, if coal were used as a substitute for oil and natural gas as those reserves are depleted. Energy conservation can provide us with the time needed to develop alternate energy sources such as solar, geothermal, wind, and nuclear power.

Much energy is used to manufacture and process the items we buy. Products made from used or recycled materials generally take less energy than products made from new materials. For example, new aluminum uses 20 times as much energy as recycled aluminum, new paper uses twice as much energy as recycled paper, and man-made fabrics use 10 times as much energy as natural fabrics. Every ton of steel produced from recycled waste instead of raw ore does the following things: (1) saves enough energy to power the average American home for eight months, (2) eliminates 200 pounds of air pollutants, (3) reduces fresh water consumption by 6,700 gallons, (4) reduces wastes discharged into water by 107 pounds, and (5) eliminates about three tons of mining wastes. Throwing away one bottle wastes as much energy as a 100-watt bulb uses in four hours.

Recycling is not a modern concept. Pioneers recycled metal into buttons by taking old spoons and other pieces of worn-out tableware, melting them, and casting them in molds which had been cut into blocks of soapstone. Lemon and orange peels were also saved, dried, and used as a substitute for kindling wood. It not only revives a fire but also lightly perfumes a room.

The fuels which we have used for our personal needs have also taken us into the space age. These fuels, however, are rapidly being exhausted. At several times in history we have located new sources of energy and approached them with the idea that the supply was inexhaustible. Now we are beginning to realize that the earth is limited in its ability to satisfy our demands.

Our use of energy has extended beyond needs into the category of wants. The U.S. has traditionally been proud of substituting mechanism for muscle power, yet now must face the hard facts that the energy required is quickly being depleted. Energy conservation needs to dwell on the careful and intelligent use of the resources we have.

The average American produces about 4 1/2 pounds of trash per day, yet things can be done to reduce the national solid waste problem which has developed. Some companies pay out money to consumers who recycle and some craft shops contain items which have been recycled in a creative manner. In addition to reducing consumption of materials and reusing what we normally throw out, we need to look again at our buying habits. As you can see, it makes more sense to purchase products that are long-lasting and recyclable.

Some of the activities in the 6th grade packet require between 20 and 40 minutes depending upon the length of discussion. Others require research and planning; therefore, they can be considered long-range in nature. The classroom teacher is best qualified to set the amount of time for these activities. There are also activities designed to be done at home and follow-up provided in the classroom.

Grade 6 - Packet "A"

Energy

Goal 1.00 The learner recognizes the limits of energy sources.

The learner:

1.1 Becomes aware of what sources of energy cannot be reused.

1.2 Recognizes the difference between renewable and non-renewable energy sources.

1.3 Understands the relationship between life style and energy resources.

1.4 Recognizes that economic factors limit energy development and use.

1.5 Sees that dependence upon one energy source is limiting.

Personal Accommodation

Goal 2.00 The learner will develop a conservation ethic in regard to energy.

The learner:

2.1 Recognizes that every decision made involving energy affects standards of living.

2.2 Becomes aware of how social pressures to have things and use energy are created.

2.21 Becomes aware of the effect of the bias of media advertising and peer pressures.

2.3 Realizes that individuals may band together to effect choices in the social, economic, and political realms.

2.4 Acquires experience in making decisions and accepting the consequences of the decisions.

2.5 Expresses personal value that is received from energy conservation.

2.6 Chooses activities which will utilize energy conservation in making contributions to the school and community.

2.7 Investigates methods concerned citizens use to improve the future of energy solutions.

2.8 Develops an idea of the type of life style desired in consideration of the amount of energy required.

2.9 Explores the selection of life styles if energy conservation is not practiced.

ENERGY ACTIVITIES
Grade 6 - Packet "A"

Goal 1.00 The learner recognizes the limits of energy sources.

Objective 1.1 The learner becomes aware of what sources of energy cannot be reused.

A. Students prepare a display of renewable and nonrenewable energy resources. Encourage research and have students provide real samples whenever possible. (1.1)

B. Students prepare reports on why the various types of fossil fuels are non-renewable. (1.1)

C. The students write short stories explaining what the earth will be like in the year 2000 in terms of energy resources. How will they travel from place to place? How will their homes be heated? What types of jobs will be available in the field of energy? (1.1, 2.9)

Objective 1.2 The learner recognizes the difference between renewable and non-renewable energy resources.

A. Use *Master #1, pg. a*, which is a scrambled word puzzle using examples of energy that cannot be reused. The students unscramble and then list the words. Use *Master #2, pg. b*, for a review of energy terms. (1.2)

B. Study the characteristics of reusable and non-renewable energy resources. Visit a compost pile or recycling center.

C. Use activities from the above section to emphasize the point that a difference does exist between renewable and non-renewable energy sources. (1.2)

Objective 1.3 The learner understands the relationship between life style and energy resources.

A. The class lists the natural resources needed to build an automobile and make it run. On a world map, mount a toy car at Detroit; then using different flags and yarns for each resource, pinpoint the primary sources of supply and connect to Detroit. How many countries are involved? What would happen if the major producers cut off the supply? (1.3)

B. Make a collage of pictures showing your life styles, or make a banner with a symbol which represents your life style. (1.3)

C. Students write what their lives might be like in the year 2000 with respect to energy consumption. (1.3)

Suggestions for "starters": (*Master #3, pg. c.*)

1. Imagine you are writing in your diary, "It is the first day of the year 2000, and it seems ages ago that I was in school. So much has happened." (Go on to explain.)

2. Imagine you are age 47 in the year 2000 and are writing to your son. "You have criticized me and my generation for the mess we have made of the world." (What else would you say?)

D. Credit: "The Energy Question: Problems and Alternatives," Intercom, September, 1973, pp. 12-16.

Write stories describing a blackout, what caused it, how people reacted, what life was like, etc. Share these with the class. Use *Master #4, pg. d,* as a starter. (1.3)

E. Have the class list their uses of electricity. These should be listed in order from necessary to unnecessary. Then let them describe their living conditions if they were to be without various uses of energy. From this discussion they could develop a scale from a level where they are unable to survive to a level of extreme luxury. (1.3)

F. Have the class list 10 of their favorite possessions that are made from oil or gas. This would be an excellent time to review how oil and gas serve as raw materials in synthetic fibers, plastics, etc. Then discuss what might happen to the cost and availability of these items as oil and gas become even less available. (1.3)

G. Plan a diary for a weekend during which little "outside" energy would be used--no bus, car transportation, no heating/air conditioning, TV, phone. Parts of these diaries could be shared in class. (*Master #5, pg. e*). (1.3)

H. Describe the living conditions of an American farm family and a farm family in India. Include in the comparison working hours, lighting, education, water source, cooling, diet, recreation, transportation, family size, and relate the energy available to the individuals. (*Data Sheet #1, pg. f*) (1.3)

I. Describe and create ways in which energy can be used to beautify the surroundings. (1.3)

J. Researching sun legends can be an historical and rather romantic activity. Students will enjoy finding stories about sun gods, ceremonies and legends. Civilizations to research are: American Indians (especially the Plains and Southwest tribes as well as the Natchez Indians from the Southeast. The Incas, Aztecs, and Egyptians also had interesting beliefs, customs and ceremonies related to the sun. (1.3)

K. A follow up activity to Activity "J" above is to encourage students to write original sun legends. (1.3)

Objective 1.4 The learner recognizes that economic factors limit energy development and use.

A. When a resource begins to become scarce, it is due in part to the difficulty of finding it, taking it out of the ground, processing it for use, and transporting it to market. Choose an energy resource and discuss what jobs might be created or eliminated as it becomes more scarce. (1.4)

B. Have students contact various sources such as industries, utility companies, etc. in order to learn more about the flow of dollars spent on energy resources in your community. (1.4)

C. Announce to the class that the government will allow each family only a certain number of gallons of gasoline per week for their cars, lawn mowers, etc. Discuss how putting limits on an energy resource could extend the useful life of a resource. (1.4)

D. Write letters to engineers at auto production plants to find out whether they are designing cars with better gas mileage. Ask them how much better the gas mileage will be, whether the government is forcing them to do this, and when these cars will be ready. (1.4)

E. Students take the part of the directors of the electrical company when they are making the decision about whether or not to build a new atomic plant. They could contact utility companies and community organizations to get background material in planning a more realistic debate. (1.4, 2.2)

F. Those not involved in the previous experience could choose a role-playing situation with various people involved in the decision making process about using atomic power rather than coal. Different possible positions could include the farmer who doesn't want to give up land for the new plant, a coal mine owner, an atomic power plant director, and a housewife that wants more power for her appliances. (1.4, 2.2)

Objective 1.5 The learner sees that dependence upon one energy source is limiting.

A. Invite a speaker from a local utility company to explain to the class about the manufacturers and suppliers on whom it depends. (1.5)

B. Tell the class that local stores have all announced that due to a transportation strike there will be no more candy bars sold. This will last for quite some time. Have the class discuss what will happen to the supply presently in the stores, how the supply will be distributed, what will happen to the price, and then have them explain what they would be willing to do to get some of the available candy bars. Relate this to limits on energy sources and ask what they would be willing to do to get some of the energy source which is almost gone. (1.5)

C. Make a list of industries and products which are now dependent upon fossil fuels that will not be able, in the future, to switch to other energy sources. (1.5)

D. Show *Transparencies #1-4, pp. g-j,* to help students see a total picture of what is going on with energy in the world. Discuss and use wall maps too. (1.5)

Goal 2.00 The learner will develop a conservation ethic in regard to energy.

Objective 2.1 The learner recognizes that every decision made involving energy affects standards of living.

A. Write letters to the major industries in your community. Write letters asking them to describe their approach to energy conservation. (2.1)

B. Use a tape recorder to ask family and friends what they have done to contribute to the solution of an energy shortage. Play back in class and discuss. (2.1, 2.8)

C. Student Reports--Famous Scientists

Using *Master #6, pg. k,* as a guide, students will study the lives and scientific accomplishments of renowned energy researchers. (2.1)

D. Distribute copies of *Master #7, pg. ℓ.* This exercise will help students in making value judgements. After the students have completed the sheet, discuss the ranking they have done. (2.1)

Objective 2.2 The learner becomes aware of how social pressures to have things and use energy are created.

A. Have the class study magazine advertisements about energy and power. Then have them create ads from the positions:

1. Environmentalist
2. Mother Earth
3. Power Producer
4. Business person

These ads could be presented to a group of parents. Ask the parents for their reactions, thus creating a discussion. (2.2)

B. Invite a speaker from an environmental group, a government agency, and a local power company to talk about energy problems in the community. The students should prepare questions ahead of time for a question and answer period.

C. Values Sheets--Values Clarification Activity

Provide students with copies of the Values Sheets (*Masters #8, 9, pp. m-n*). These are to be completed individually and handed in. They would serve as a form of evaluation as to the effect of a study of energy on the student's attitudes. These can be used as pre- and post-activities. (2.2)

D. Values Continuum--Values Clarification Activity

The teacher identifies an issue (see suggestions, or make up your own) and draws a long line on the board. Then place the two polar positions and mark a series of points along the continuum. Say, "Between the end points there are many positions. I am going to whip quickly around the room and ask you to tell me where you stand on this issue. Briefly describe your position without giving reasons. You may pass if you wish."

If clustering occurs, you may wish to have the students write the answers on a piece of paper and the teacher randomly selects a few to be placed on the board. Discuss. (2.2)

Suggestions

1. What should the U.S. attitude be toward energy sources in other countries?

PURCHASE ALL ENERGY FROM OTHER COUNTIRES	.....	PURCHASE NO ENERGY FROM ANY COUNTRY

2. How much do you watch TV?

BLURRY-EYED BILL-- Never Turns It Off	.....	NO-KNOB NED-- Never Turns It On

3. How do you feel about automobile transportation?

AUTO-GO Use for Everything	.....	AUTO-QUIT Use As Little As Possible

Objective 2.3 The learner realizes that individuals may band together to effect choices in the social, economic, and political realms.

A. Divide the students into groups to study the energy problem. Have each group appoint a recorder, math consultant, and researchers. The recorder keeps accurate records of everything, the researchers inform the group of news items, TV broadcasts, and conduct surveys. The math consultants meet with the teacher to make certain they can work the problems and then make sure that each member of the group knows how to work the problems. (2.3)

Survey: How many students have turned their home thermostats down to 68 degrees?

Assign rooms to each group and ask them to show their survey form to you before taking the survey.

Problem: Use the data from the survey to figure what percentage of the students had turned the heat down.

Example:

Room	Total Number of Students	Number Who Turned Down Heat	Percent
12	22	20	91

B. The class prepares a tape-slide show depicting energy conservation, future energy sources, limits to energy, or all. This could be presented to other grade levels, to parents, or to interested groups in the community. (2.3)

Objective 2.4 The learner acquires experience in making decisions and accepting the consequences of the decisions.

A. Announce to the class that an ordinance has been passed ordering all users of electric energy to reduce their use by one-half. The students should be ready to explain what they will choose to do without and why. (2.4, 2.8, 2.9)

B. Percentage Questions--Values Clarification Activity

The teachers reads several percentage questions, one at a time, to the students. The students write down their own answer to each question. Once this has been completed, the teacher breaks the class into small groups to share and discuss their answers. After they spend a short time on discussion, they are to think for a minute about what they have just learned. Students volunteer to share their "I learned..." statements. (2.4)

What percentage of:

1. time do you spend watching TV?
2. your free time do you spend reading books?
3. your lights at home are on most of the evening?
4. your family takes showers instead of baths?
5. your letters in the past month have been to encourage people to conserve?
6. your family is willing to recycle?
7. your family is willing to drive the car less?
8. the time your family drives the car is spent driving at, or under, the speed limit?

Objective 2.5 The learner expresses personal value that is received from energy conservation.

A. Students write articles to the local newspaper as a result of establishing an energy conservation value. This is expressed in their articles as to what should and could be done. (2.5, 2.7)

B. Values Whips--Values Clarification Activity

The teacher poses a question to the class and allows a few moments for the students to think about their answers. The teacher then whips around the room calling upon the students to give their answers. These answers should be brief and to the point. Any student may wish to pass. (2.5, 2.8, 2.9)

Questions:

1. What does your family do together?
2. What would you do if you couldn't watch TV?
3. Is there something you have done lately to conserve energy? Are you proud of what you did?
4. How did you take a public stand on energy conservation recently?
5. How would your life change if you had no electricity?
6. Why can't we continue to use all the fossil fuel we want?
7. How has your family reduced its utility bill?

Objective 2.6 The learner chooses activities which will utilize energy conservation in making contributions to the school and community.

A. Developing a class newspaper with an energy theme is a great summarizing activity to an energy unit. Students can write articles, riddles, Do You Know questions, and energy tips. Original cartoons, word searches, and puzzles are possible features. Activities from the ECAP notebook can be adapted such as activities J and K, 1.3, Packet A on sun legends. The class might discuss to whom the paper should be delivered. Students, families, PTA members, school personnel, utilities company staff, city councilmen, even state and national legislators might be considered. (2.6)

Objective 2.7 The learner investigates methods concerned citizens use to improve the future of energy solutions.

A. Compare utility bills from several different households to have the students attempt to discover why one family may use more kilowatt-hours than does another. (2.7)

B. Students interview their parents and report back on how the family's use of the automobile has changed due to a decrease in the amount of energy available. (2.7, 2.8)

Objective 2.8 The learner develops an idea of the type of life style desired in consideration of the amount of energy required.

A. Have the students pretend they are going on a camping trip 200 miles from home. The vacation is to last two weeks. They are to spend as little money as possible, spend as much time in the wilderness as possible, and contribute as little pollution as they can. Provide students with a copy of *Data Sheet #2, pg. o* on which they will select their mode of travel, cooking fuel, housing enroute, housing at the campsite, types of activities at camp. (2.8)

B. In preparing small amounts of food, portable ovens, skillets, and broilers usually use much less energy than does a larger oven. (2.8)

SKILLET PIZZA

1 can (8 oz) refrigerated crescent rolls
Butter or margarine
1 can (8 oz) pizza sauce OR 1 can (6 oz) tomato paste
1/8 t. oregano
Parmesan cheese
6 - 8 slices Mozzarella cheese

Unroll dough and separate into eight triangles. Place in cold ungreased electric frypan and shape to cover bottom of pan. Pat dough about one-half inch up sides of pan. Brush with butter or margarine. Spread pizza sauce evenly over dough. Sprinkle oregano over sauce; top generously with Parmesan cheese. Arrange slices of Mozzarella cheese over all. Cover and bake with vent closed at 300° for 20 minutes. Open vent or leave lid ajar for the last five minutes. Cut into squares and serve hot. Yield: 8-10 servings.

NOTE: Pepperoni slices add authentic Italian flavor and aroma; use 1/4 to 1/2 pound.

Objective 2.9 The learner explores the selection of life styles if energy conservation is not practiced.

A. Distribute copies of *Master #10, pg. p*, and ask the students to study the list of habits. Announce that they will have the choice of doing this activity alone or with their family. Once the list has been studied, they should make an agreement with themselves (or the family does) describing precisely how they will handle the habit. After one week's time the class can share the progress. This could conceivably become an on-going activity in which a new agreement is formed once the first is completed. (2.9)

ENERGY CONSERVATION ACTIVITY PACKETS

GRADE 6

PACKET "B"

TEACHER BACKGROUND MATERIAL
Grade 6 - Packet "B"

It has been estimated that the average American uses the following energy resources each day: 13.6 pounds of coal, 3.3 gallons of oil, 297 cubic feet of natural gas, 3.7 kilowatt-hours of hydroelectric power, and .7 kilowatt-hours of nuclear power. In a lifetime, a person in the U.S. consumes 170 tons of coal, 2,000 barrels of oil, and 7.5 million cubic feet of natural gas.

If you had lived in the year 1900, you would have used only 25% of the energy you use today. In the year 2000 you will use almost twice as much as you use today if demand continues at the present rate. Additional energy sources exist, but require research for practical development and implementation, and that requires time and money.

The time has arrived for an energy transition, but this one will be unlike the two the U.S. has previously experienced. After the Civil War, coal replaced wood, windmills, and waterwheels. In the 1950's, oil and natural gas replaced coal. These transitions were not the result of shortages as the present one will be. If we act now to conserve our present energy resources and to develop additional energy sources the transition can be orderly. If delays arise too frequently and voluntary cooperation does not occur, more drastic measures such as rationing, etc. will be enacted to conserve our present energy resources.

a. Geothermal energy is largely untapped and additional research is needed to best determine how it will relieve the shortage. Geothermal heat is clean and much less expensive to use than fossil fuels. Sometimes, however, the steam contains objectionable gases. Most of the potential for geothermal energy in the U.S. is in California, Montana, and other western and Gulf Coast states. Reykjavik, the capital of Iceland, heats all of its buildings by natural hot water.

b. Water has long been a useful energy source; however, in the U.S. it is presently responsible for only about 15 percent of the total generating capacity. Investigation is being conducted to determine how feasible it is to extract large amounts of energy from ocean waves. Dams have already been built on the largest rivers to harness hydropower.

c. Shale deposits are mainly located in Colorado and Wyoming or government lands. Shale is a resource base for oil. High risks and high costs are involved in its development and these environmental and economic problems must be overcome.

d. Solar energy is an inexhaustible source of energy and is clean and renewable. About the only practical use of solar energy today is converting it to heat for space heating and domestic hot water heating. Experimental homes and buildings are already being studied to test how solar energy can efficiently be used to heat them. Research projects of this nature have been initiated in Iowa (i.e. Living History Farms, Raccoon Valley State Bank, Scattergood School in West Branch, Iowa). A long-term plan of the Energy Research and Development Administration is the development of commercially feasible ways to generate electricity directly from solar energy. Gerald Kline, head of the United States Department of Agriculture grain storage and drying research in Ames, is working to develop solar grain drying techniques.

   In the summer of 1980, he commented that the research was showing that in the western corn belt solar grain drying is "a long way from economic feasibility" because of limited effectiveness and overdrying. Research also involves multiple use collectors for both grain drying and domestic hot water and space heating.

e. Wind is a secondary form of solar energy. Wind power has been used for such mechanical tasks as pumping water, grinding grain, etc. since the time of the Romans. About 1900 the U.S. was utilizing wind energy for the very efficient clipper ships and windmills pumped water, generated electricity, and sawed wood. Fossil fuels were then found to be a more consistent, easily obtainable source of power but these have become very expensive as supplies dwindle. It has been estimated that the winds of the continental United States have about five times the total of our average power demand. Generally, the Great Plains and Northeast States have winds with enough strength (over 7 mph) to be of value. The major obstacle in using wind energy is its variability. Scientists still have much to learn about the most efficient equipment and the wind's behavior before the windmill returns to the scene.

f. Basically there are two types of nuclear activity being used or considered to supply energy. Nuclear fission is the breaking apart of the nucleus of atoms of uranium, thorium, or plutonium. The chain reaction which is required in this process is difficult to control. Only 1% of our total energy comes from nuclear powered plants. Nuclear fusion is the bonding together of very light nuclei, such as hydrogen or helium. Scientists are still working to harness nuclear fusion. The technological implementation of nuclear power is expensive, and the environment needs to be protected from radioactive wastes, thermal pollution, explosion, and radioactive leaks.

g. Organic wastes have been gaining more attention as the U.S. disposes of millions of tons of organic wastes. Until recently, little attempt has been made to return these wastes to the soil or convert them. Some of these waste materials can be converted to methanol, methane gas, or burned directly as solids.

Some of the activities in the 6th grade packet require between 20 and 40 minutes depending upon the length of discussion. Others require research and planning; therefore they can be considered long-range in nature. The classroom teacher is best qualified to set the amount of time for these activities. There are also activities designed to be done at home and follow-up provided in the classroom.

GOALS AND OBJECTIVES IN ENERGY CONSERVATION

Grade 6 - Packet "B"

Energy

Goal 1.00 The learner develops an understanding of alternative methods of energy.

1.1 Identifies principal energy sources which may be available in the future.

1.2 Becomes aware of energy flows.

1.3 Recognizes that energy availability will affect future life styles.

Personal Accommodation

Goal 2.00 The learner will develop a conservation ethic in regard to energy.

2.1 Recognizes that every decision made involving energy affects standards of living.

2.2 Becomes aware of how social pressures to have things and use energy are created.

2.21 Becomes aware of the effect of the bias of media advertising and peer pressures.

2.3 Realizes that individuals may band together to effect choices in the social, economic, and political realms.

2.4 Acquires experience in making decisions and accepting the consequences of the decisions.

2.5 Expresses personal value that is received from energy conservation.

2.6 Chooses activities which will utilize energy conservation in making contributions to the school and community.

2.7 Investigates methods concerned citizens use to improve the future of energy solutions.

2.8 Develops an idea of the type of life style desired in consideration of the amount of energy required.

2.9 Explores the selection of life styles if energy conservation is not practiced.

ENERGY ACTIVITIES
Grade 6 - Packet "B"

Goal 1.00 The learner develops an understanding of alternative methods of energy.

Objective 1.1 The learner identifies principal energy sources which may be available in the future.

A. Credit: A Teacher's Handbook on Energy, Colorado Department of Education, Denver, Colorado 80203.

Have the class list 15-20 pairs of alternative ways of doing things commonly found in our way of life, such as the following:

1. Dishwasher vs. doing dishes in the sink
2. Fan vs. air conditioner
3. Power mower vs. hand mower
4. Electric razor vs. blade razor
5. Bath vs. shower
6. Gas stove vs. electric stove
7. Electric sweeper vs. broom
8. Automobile vs. bicycle

Ask the students, working in pairs, to select one of the alternatives and to compare/contrast the amount of energy used and the benefits received from the alternative they have selected. Encourage the students to think seriously about the advantages of both alternatives. Ask each pair of students to identify to the class the alternative they prefer and see if the class supports or does not support their choice. (1.1)

B. Show pictures (*Filmstrip #2, pp. 9-t*) of wind, geothermal, solar, solid waste, etc. as future sources of energy to stimulate interest and to prepare for the next activity. (1.1)

C. Students prepare reports and displays of potential energy sources which may be available in the future. (1.1)

Geothermal
Wind
Tides
Coal Gasification
Sewage
Hydrogen
Nuclear Fission
Nuclear Fusion
Solar
Garbage--Solid Waste

Use the following issues of the National Geographic Magazine for information and pictures: November, 1972, "The Search for Tomorrow's Power," pp. 650-681; March, 1976, "Solar Energy, the Ultimate Powerhouse," pp.381-397; and December, 1975, "New Energy from an Old Source: The Wind," pp. 812-829.

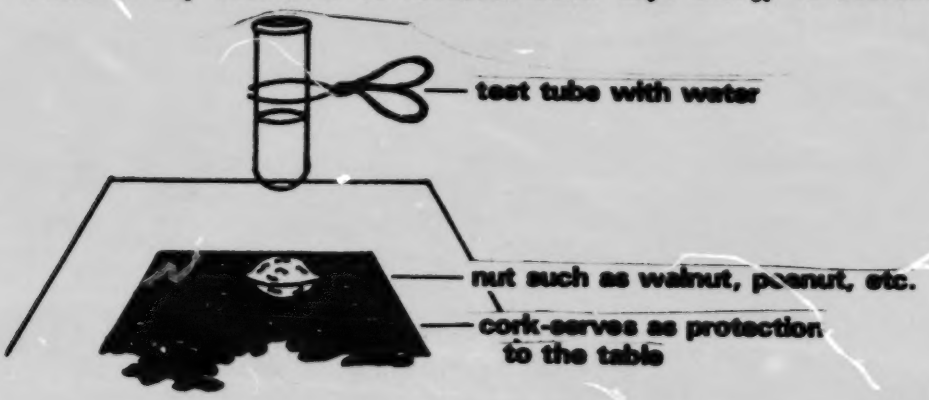
D. Students attempt to design and build models of possible future energy producing devices--especially in the areas of wind, water, solar. (1.1)

E. Demonstrate the heating effect of sunlight. Put a pan of water in the sun and a similar pan with the same amount in the shade. Compare the temperatures. Discuss, "How can this heat be used?" (1.1)

F. Remove the handle from an old umbrella, line the inside of the umbrella with aluminum foil, and point it at the sun. Concentrate the focused energy on a beaker of water and describe the result. Solar cookers built with concave mirrors can roast meat and some very large solar furnaces will give temperatures so high they can boil iron. *Experiment Sheet #1, pp. u-v*, could be used if there is interest or could be used in a learning station.

Solar cells have been developed that capture solar energy and convert it into electricity. This can be used right away or stored in batteries. (1.1)

G. Storage of solar energy in plant materials can be demonstrated by burning a nut and measuring the rise in temperature of water. Students may then wish to research other ways energy is stored. (1.1



H. Make sun tea. Use cold water and tea bags in a jar. Put the lid on tightly and place in the sun. Watch the color in order to tell when it is ready. (1.1)

I. If possible, visit a nearby home or other building which uses solar energy for heating purposes. Make a list of questions you could ask and do some research or background reading in preparation for your trip. Allow time for follow-up discussion and activities upon your return to the classroom. (1.1)

J. Locate picutres of nuclear electric generating plants. Identify the purpose for each of the major structures. (1.1)

K. Have students select the source of electricity they think will be most used in the future. Information should be found to substantiate the choices. If possible, have them identify the economic aspects of the energy source. (1.1)

Objective 1.2 The learner becomes aware of energy flows.

A. Energy cannot be recycled because it is neither created nor destroyed. Energy is not consumed but changed in form. Use *Transparencies #1, 2, pp. w-x*, to aid in the explanation and discussion. (1.2)

B. The students list household items which can be used again. Then have them check the items that their families recycle. Finally, the students can list the items in the order of their recycling frequency. To make this activity more meaningful, have each student select a product (i.e. paper bag) and record the number of time it is used. (1.2)

C. Visit a bottling plant and find out what the company is doing about recycling. If it is not possible to visit one, write a letter. Discuss methods and costs of recycling in contrast to throw-away containers. (*Transparency #3, pg. y.*) (1.2)

D. Take time to review with the class that people can save energy when they do not waste things. Whenever a thing is discarded, the energy that went into the production of it is lost. Each time a person wastes food, paper, water, paper towels, etc. they are wasting energy.

Help the class develop a list of things that are often wasted in their homes. In addition to the items mentioned above, it will also include other common products and items such as electricity, gas, soap, hot water, etc. Use *Data Sheet #1, pg. z*, and have the students plan to record on the chart daily for one week their personal scores on saving or wasting. Each time they do something that saves energy they are to give themselves a plus (+) and each time they waste energy they are to give themselves a minus (-). At the end of the week discuss: Where did they save the most energy? When was it most difficult to save energy? Were they successful in changing wasteful habits? Did they notice a change in other members of the family?

E. Bring the following materials in order that the class may experience the recycling of paper:

newspapers
mixing bowl
egg beater
wood block
window screen (5x6 inches square)
plastic sandwich bag
wallpaper paste or corn starch
water
elum (Optional - it eliminates the odor of wet newspapers)

Now follow the directions (*Master #1, pg. aa*).

1. Fill the bowl one-fourth full of water.

2. Tear one-half of a newspaper page into pieces and put into the bowl to soak for an hour.

3. After it is soaked, beat it with an egg beater until it is the consistency of sour cream.

4. Dissolve two heaping tablespoons of the wallpaper paste or corn starch in a pint of water, then pour into the bowl and stir.

5. Hold the piece of window screen flat and lower it into the pulp in the bowl. Repeat this until you have a layer of pulp about one-tenth of an inch thick.

6. Set the screen on a newspaper and place the plastic sandwich bag over it. Press down with the wood block--first gently and then with more pressure.

7. Allow the fibers to dry for about 24 hours. Then peel the fiber, then the paper from the screen.

Discuss with the class what fuel furnishes the energy for the process in a plant. Have them find out how the cost of recycled paper compares with the cost of paper from virgin timber. Ask the students to check in stores while shopping with their parents to find how many articles are made of recycled paper. How can they help to recycle paper? (1.2)

Objective 1.3 The learner recognizes that energy availability will affect future life styles.

A. Have the students compare car advertisements of today with those of five or six years ago. What did car manufacturers stress then? Now? How do the differences relate to the energy crisis? (1.3)

B. Discuss whether garbage utilities might be able to cut costs by requiring the householders to separate cans, bottles, and burnable trash. Contact the garbage utility and find out whether this has been considered, if it will save energy and money, and whether they plan to try this in the near future. (1.3)

C. Divide the class into groups and ask each group to list the characteristics of a life style they think would be most satisfying. From these lists, combine and arrive at a list of characteristics of the "good life". Then have the groups meet again to design a life style which uses as little energy as possible and uses as many of the characteristics from the class list as possible. (1.3)

D. Announce to the class that gas is permanently rationed to five gallons per week per family. The class then discusses which of their present habits will be changed due to the gas rationing. (1.3)

E. Students suggest several alternatives to the prospect of a permanent gasoline shortage. The students then select one of the alternatives and prepare to define the choice to the class. (1.3)

Possible alternatives might include:

1. rationing one automobile per family
2. no government interference
3. raising gas prices (taxing gas)

F. List 10 ways you can directly use less energy in your daily life. List 10 direct energy uses which make life more enjoyable for you. Discuss both lists as a class. (1.3)

Goal 2.00 The learner will develop a conservation ethic in regard to energy.

Objective 2.1 The learner recognizes that every decision made involving energy affects standards of living.

A. Discuss whether happiness is equated with energy--considering luxuries. What would you be willing to give up right now? (2.1)

B. List, in order, your uses of electricity from necessary to unnecessary. Let the students describe their living conditions without various uses of energy. Then have them develop a scale from a level where they are able to survive to a level of extreme luxury. (2.1, 2.8, 2.9)

C. Credit: The University of the State of New York, The State Education Department. Living Within Our Means: Energy and Scarcity, Environmental Education Instructional Activities, K-6.

To develop an awareness of the impact of inventions on our economy, have pairs of students research the lives and inventions of such men as Eli Whitney, Cyrus McCormick, Thomas Edison, Alexander Graham Bell, Andrew Carnegie, Henry Ford, the Wright brothers and others. One of the students researches the inventor's personal life while the other examines how the economy and society was affected by the individual's accomplishment (*Master #2, pg. bb*)

In the presentation to the class, the one narrates the personal struggles of the inventor with emphasis on obstacles, discoveries, and effects on his life. The other describes how work, travel, communication, and industry were changed and lists the products, conveniences, and economic advantages generated by the invention. (2.1, 2.8)

After the presentations, consider the following questions for discussion:

1. As a result of these inventions, what natural resources became more valuable and important?
2. How did these inventions create millions of new jobs or businesses?
3. What new problems were created as a result of these inventions?
4. Why must one carefully examine what effect a new invention will have on the environment?
5. Why shouldn't low cost and convenience be the only consideration one uses in determining the worth of new machines?
6. What rules would you make before allowing a new invention to be marketed or used? Why?

Objective 2.2 The learner becomes aware of how social pressures to have things and use energy are created.

A. Collect and display advertisements illustrating methods industry has used to implement energy conservation policies. Discuss and react to them. (2.2)

B. Learn about legislation which is being proposed or adopted regarding the energy situation. Find out what legislation has been passed and what is being proposed so there will be both mandatory and voluntary conservation. Write letters to your legislators and congressmen. (2.2, 2.7)

Objective 2.3 The learner realizes that individuals may band together to effect choices in the social, economic, and political realms.

A. Form an energy saving committee to warn others of energy misuse and waste. This committee could be helpful in the school by talking to other classes and it could also set up an information booth in a public place. (2.3, 2.4, 2.5, 2.7)

B. Write to organizations requesting energy materials (American Association of University Women, League of Women Voters, CURE, etc.). Compare the positions taken by two or more of these groups concerning a given controversy. How do they agree? How do their views differ? (2.3, 2.7)

Objective 2.4 The learner acquires experience in making decisions and accepting the consequences of the decisions.

A. Distribute copies of *Master #3, pg. cc.* Give them an opportunity t circle those things they could do adequately in their homes without electricity. Then ask the students to explain how they would accomplish those things without electricity. (2.4, 2.8, 2.9)

B. Design posters or write newspaper editorials to convince people of the importance of planning ahead to insure adequate usable energy sources for the future. (2.4, 2.5, 2.6, 2.7)

Objective 2.5 The learner expresses personal value that is received from energy conservation.

A. Hold an energy education fair where student-prepared models and charts are displayed. They could also present a media show using student-made slides, films, and tapes. (2.5, 2.6, 2.7)

Objective 2.6 The learner chooses activities which will utilize energy conservation in making contributions to the school and community.

A. Alternatives Search--Values Clarification Activity

Provide each student with a copy of the chart (*Master #4, pg. dd*) and present the students with the following values issue, or one of the additional suggestions. Each student brainstorms as many alternatives as he or she can think of in 3-5 minutes. Then they should check the appropriate column for each alternative. They may share thoughts with the class if they wish. (2.6)

Additional Suggestions:

1. Future energy sources
2. Ways to help our school conserve energy
3. Ways to help our family conserve energy
4. Ways to make our voices heard on the energy problem.

B. Consequences Search--Values Clarification Activity

This is used as an activity after the Alternatives Search. It is just as important to evaluate consequences as it is to search for alternatives.

Provide each student with a copy of *Master #5, pg. ee.* At the top they are to place the three most feasible solutions to the energy shortages. Then, for each of the alternatives, they are to list as many possible consequences as they can think of. This may be done individually or in small groups. After considering the consequences, they should re-evaluate their positions. This could mean a re-ranking of the alternatives. (2.6)

Objective 2.7 The learner investigates methods concerned citizens use to improve the future of energy solutions.

A. After a visit to a local county government or city council meeting, explain the process by which a concerned citizen gets his energy concerns discussed by local decision makers. The students develop a graph or picture to show the process. (2.7)

B. Write articles or letters for the newspaper (school and/or local), letters to legislators and congressmen, letters to the mayor, governor, president, etc. These would show the result of establishing a conservation value. (2.7)

Objective 2.8 The learner develops an idea of the type of life style desired in consideration of the amount of energy required.

A. Students could become citizens of a model community. First have them list what they consider to be problems of their existing community. They could also collect magazine and newspaper articles concerned with problems.

Announce that each student is to consider himself a citizen of a future and totally new community. Let the class discuss how they would want this new community to be different from the present one. This could include which problems they would like to see solved, begin to think of a name for the community, and consider how they could solve some of the energy problems of today so their new community would not experience these.

Research needs to be done on energy sources so encourage students to: talk with parents; invite plumbers, heating contractors, representatives of oil, gas, coal and electric industries in the community; take trips to local mine, refinery, and generating plants. Then plan a community meeting for the purpose of sharing information and deciding which one source of energy to use for heating and cooling homes. (2.8)

B. Students construct a model society that contains the "good life." Then use this model to make judgements about resource use, but remember to consider self and others. (2.8, 2.9)

Objective 2.9 The learner explores the selection of life styles if energy conservation is not practiced.

A. Have the class list restraints that might result from over-population. (2.9)

B. Have the class describe what the quality of life might be like with severely restricted energy resource conditions. They might enjoy making drawings or even a mural. (2.9)

C. Credit: A Teacher's Handbook on Energy, Colorado Department of Education, 1974.

Show *Transparencies #4-7, pp. i-ii* and discuss the attitudes toward energy. (2.9)

ANNOTATED CHILDREN'S BIBLIOGRAPHY
Grades 4-6

BOOKS AND PAMPHLETS

Adler, Irving and Ruth. Coal. John Day Company, New York, 1965, 47 pp., $3.96. The book traces the development of coal, how it is mined, its uses, and its many by-products.

Adler, Irving. Energy. John Day Company, New York, 1970, $3.96. Practical examples of changes from one form of energy to another are given.

Adler, Irving. Petroleum: Gas, Oil, and Asphalt. John Day Company, New York, 1975, 48 pp., $5.95. This is aimed more towards the science-oriented. It has concise coverage of the story of oils and gas. It includes definitions, formation, location, and extraction of petroleum.

Baer, Steve, Sunspots. Published by Zomeworks Corporation, Albuquerque, NM 87103 - $3. Basics on solar collectors, with humor.

Baylor, Byrd. The Way to Start A Day. Charles Scribner's Sons: New York, 1978. Text and illustrations describe how people all over the world celebrate the sunrise.

Benrey, Ronald M. Nuclear Experiments You Can Do. Thomas A. Edison Foundation, Inc.: Michigan, 1976 booklet containing some basic facts about nuclear energy and related experiments. It is designed to aid in the understanding of nuclear energy.

Berger, M. Energy from the Sun. Thomas Crowell Co., New York, NY, 1976, 33 pp., $5.95. (grades K-4).

Central Iowa Power. Play It Safe is a comic-style coloring book for upper elementary students. For free copies contact the local utility in western Iowa.

Dalton, R. All About Energy. American Museum of Atomic Energy, Oak Ridge, TN, 1974. (grades 1-4).

Eldridge, Frank. Wind Machines, report prepared for NSF, 1975, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 038-000-00272-4, $2.25. The large-scale format and many excellent photographs and diagrams will capture the attention of students of all ages. History, taxonomy, applications, siting, and performance are some of the chapters included. There is detail and technical data for the engineering-minded teacher as well as general information for the beginning student.

Halacy, D. S. Earth, Water, Wind, and Sun. Harper & Row, New York, 1977, $8.95. This is probably the best one-volume source of information on energy alternatives written for young people. The professional science writer provides a very readable digest of technical information as well as a history of the development and use of hydro, geothermal, tidal, ocean thermal, wind, bioconverted, and solar energy resources.

Halacy, Daniel S. Nuclear Energy. Franklin Watts, New York, 1978. A First Book. Straight forward text covers the development and current use of nuclear energy. It includes a brief outline of atomic theory, a history of the study of radioactivity, and describes simply how a nuclear power plant operates. The book is appropriate for junior high students. Of special interest to students are a glossary and a section on jobs in nuclear energy.

Halacy, D. S., Jr. The Energy Trap. Four Winds Press: New York, 1975, $6.95. It describes the energy crisis, its link to the gross national product, and alternatives for current and future fuel resources.

Hart, G. Kimball. How to Cut Your Energy Costs. Washington, D.C., U.S. News and World Report Books, 1978, $7.95 hardbound. Very readable, this book of practical suggestions and informative diagrams covers the gamut from home improvements to clothing, food, and cars. Recommended for home economics and consumer education classes.

Hoke, J. Solar Energy. Franklin Watts Publ., New York, NY, 1978, $4.90 (grades 4-6).

Houck, O. A. The Best Present of All. National Wildlife Federation, 1412 16th Street NW, Washington, D.C. 20036, 1976, 24 pp. This popular comic is a reprint from the Ranger Rick magazine. Single copies - free, additional copies - 15¢. (grades 3-6).

Iowa Energy Policy Council. Home Energy Savings Manual is a well written booklet that provides basic energy conservation measures for the home. It has about 75 pp. and is free. Order from the Iowa Energy Policy Council, Capitol Complex, Des Moines, Iowa 50319.

Iowa Power. Several informative and clever publications are available for students through their local utility company in central and southwest Iowa. The following booklets are offered:

The Atom and the Energy Crunch. Reddy Communications, Inc., 1976. The booklet contains information on the energy crisis, what caused it, nuclear energy, and future energy sources.

Coal and the Energy Crunch. Reddy Communications, Inc., 1976. Information on sources of coal, coal's value as an energy source, problems due to use of coal, and the importance of planning ahead are discussed.

Electric Utilities and the Energy Crunch. Reddy Communications, Inc., 1976. The booklet provides information to aid in the understanding of where electricity comes from and why the supply of power is threatened.

Exploring Energy leads classes to unravel the mysteries of energy as they take on 10 different "missions". Through quizzes and games, students become agents charged to turn coal into kilowatts, fill the energy barrel, put the sun to work, and become electricity and natural gas experts.

You and Your Electric Company uses a question and answer format to present information on energy and the operation of a utility company.

Kiefer, Irene. Underground Furnaces: The Story of Geothermal Energy. William Morrow and Company, Inc.: NJ, $4.95. Easy but accurate explanations of how four kinds of "hot spots" are formed and how they can be transformed into usable energy.

Knight, David C. Harnessing the Sun: The Story of Solar Energy. William Morrow and Company: New York, NY, 1976, 128 pp., $5.95. (grades 5-9). The book tells of past and present work in the field of solar energy and speculations on what may lie ahead.

Landt, Dennis. Catch the Wind. Four Winds Press, New York, 1976, $7.95. This survey on windpower in the U.S. and abroad is a very readable introduction for young people. Illustrations are included.

Marshall, James. Going, Going, Gone? Coward, McCann and Geoghegan, Inc.: New York, 1976, $5.49. Consideration is given to the waste of energy resources by Americans in this book. It tells us how and why we allow waste to continue.

Mattison, C. W. Man and His Resources in Today's World. Creative Educational Society: Mankato, MN, 1967, 150 pp., $6.95. This book on man's resources is well illustrated. It emphasizes conservation and touches on pollution. Also included are future power resources.

Michaelson, David R. Oceans in Tomorrow's World: How Can We Use and Protect Them? Messner, New York, 1972, $4.79. Written for junior high students, this book summarizes current and projected methods of using the oceans as an energy source. One section, "Power from the Sea," discusses tidal power.

Millard, Reed. Natural Resources: Will We Have Enough for Tomorrow's World? Messner, New York, 1972. Each chapter begins with a question relating to a specific natural resource and the possibility of its depletion. Also provides suggestions for further reading.

Podendorf, Illa. The True Book of Energy. Children's Press: Chicago, 1971. Book relates the importance of kinds of energy to children's own experiences. The book contains short sections and many illustrations.

Pringle, Laurence. Energy: Power for People. Macmillan Publishing Company, Inc.: New York, 1975, $6.95. Author urges young people to face the facts about the energy supplies of the earth.

Ruchlis, Gyman. Thank You, Mr. Sun. Harvey House Publishers: New York, 1966, 45 pp. Ruchlis provides many illustrations of how the sun helps humankind and nature.

Spetgang, T. Tilly's Catch-A-Sunbeam Coloring Book. Solar Service Corporation, P.O. Box 183, Cherry Hill, NJ 08002, 1976, $1.50. (grades 2-5).

Stolp, R. N. and Deluca F. Perspectives on Iowa Coal, 1976. Energy and Mineral Resources Research Institute, Iowa State University, Ames, Iowa 50011. This colorful and readable report provides much local information as well as background material on coal mining in general. Recommended resource for junior and senior high students.

Szulc, Tad. The Energy Crisis. Franklin Watts, Inc.: New York, 1974, 128 pp., $6.95. Author reveals many disturbing items in relation to the energy crisis and why it is here. The book also contains an explanation of why the energy crisis will continue into the future.

Thomas A. Edison Foundation, Inc. Energy Conservation: Experiments You Can Do. Michigan, 1974, 32 pp. This booklet contains many energy conservation experiments designed to bring about a better understanding of how energy can be conserved at the present time.

Wohlrabe, Raymond A. Exploring Solar Energy. The World Publishing Company, 1966, 89 pp. This resource identifies early history of sun worshippers, and how the sun provides heat and light which can be turned into electricity. It also discusses the uses of solar energy for the future.

Zim, Herbert. Waves. Morrow, 1967, $3.78. This book offers a useful introduction of tidal waves and underwater earthquakes.

BOOKS: for Teacher's Background and Reference

American Association of School Administrators. School Energy Crisis: Problems and Solutions. 1977, from AASA, 1801 N. Moore St., Arlington, VA 22209, $9.95 postpaid, discounts on orders of 2 or more. This is one of the best sources of data on the impact of rising energy costs, present and future, on school operating budgets. Examples of programs to reduce energy bills without capital spending and a guide for planning an energy cost-reduction program are included.

Carr, Donald E. Energy and the Earth Machine. New York, NY: W. W. Norton and Co., 1976, $10. Many historical insights, examples of alternatives used abroad, and a strong chapter on conservation make this a book of general interest. "The Lost Art of Conservation" was also published as a magazine article in The Atlantic, Dec. 1975, pp. 59-70.

Clark, Wilson. Energy for Survival: The Alternative to Extinction. Anchor Press/Doubleday and Co., New York, NY 1975. $4.95. One of the most extensive overviews of the social, environmental, and economic aspects of energy, this is the nearest thing to an "energy encyclopedia." Senior high students and adults will appreciate its nontechnical explanations of conventional and renewable energy uses and discussions of social and economic implications of the energy transition. An extensive reference guide to other sources is included.

Commoner, Barry. The Poverty of Power. New York, NY: Knopf, 1976, $2.25. An environmentalist examines the links between use and misuse of energy, capital, and labor in this controversial book predicting that huge energy conglomerates will become extinct.

Daniels, Farrington. Direct Use of the Sun's Energy. 1975 ed. Maryland: Ballantine Books, $1.95. This is a comprehensive summary of low-cost solar applications and the research behind it. It's the best available introduction to solar technology.

Eldridge, Frank. Wind Machines. National Science Foundation, Washington, DC, 1976, 78 pp., $30. Best available overview on wind machines with photos, illustrations and diagrams. Describes history, potential, application performance and system design of wind machines.

Fowler, John. Energy-Environment Source Book. National Science Teachers' Association, revised edition, 1978, $5., 1742 Connecticut Ave., N.W., Washington, DC 20009. This is a compilation of basic facts and issues related to energy use and supply, with emphasis on fossil fuels. Quantitative information abounds in many tables and technical appendices. Math and physical science teachers may appreciate this one most but there is a sizable section on "Energy, Society, and Environment" for social science teachers as well.

Gray, Elizabeth and Gray, David D. Growth and Its Implications for the Future. The Dinosaur Press, P.O. Box 666, Branford, CT 06405, 1975,

$3. Social, ethical, and physical constraints on growth of energy use, resource consumption, pollution, population, food production and land use are discussed in a question-and-answer format accompanied by numerous cartoons. Good selected reading.

Halacy, D. S., Jr. Wind, Sun, and Water: Our Energy Alternatives. Harper and Row, Inc., 10 E. 53rd St., New York, NY 10022, 1977, 192 pp., $9.95. Easily read. The renewable resources of geothermal, water, tidal, sea thermal energy, wind, biofuels, and solar energy are presented for consideration.

Hayes, Denis. Energy: The Case for Conservation. 1976, Worldwatch Institute, 1776 Massachusetts Ave., N.W., Washington, DC 20036, $2, for a single copy. Ask for quantity discounts. This mini-book is crammed full of energy-conserving strategies as well as a strong rationale for their use. All segments of U.S. consumption are covered. For senior high students and adults.

Hayes, Denis. Energy: The Solar Prospect. Worldwatch Institute, 1776 Massachusetts Ave., N.W., Washington, DC 20036, $2. This is an excellent, detailed summary of windpower, waterpower, biomass, and direct sunlight resources and their applications now and in the future. Recommended for teachers.

Hayes, Denis. Rays of Hope: The Transition to a Post-Petroleum World. W. W. Norton and Co., New York, NY, 1977, $3.95 (ppbk). Technological, economic, and social problems of fossil fuels versus solar are presented, with solar emerging the winner. This is a very persuasive argument for using renewable energy sources, and it includes much information on applications of alternative technologies.

Hodges, L. and Neff, J. Solar Energy 1976. Report from the Iowa Energy Policy Council, Lucas Bldg., Capitol Complex, Des Moines, IA 50319. This report is interesting reading. It describes some practical applications of solar technology in Iowa.

Lemish, J. Mineral Deposits of Iowa. Iowa Southern Utilities Co. and Craftsman Press, Burlington, 1969. Excellent resource on local mineral deposits and their potentials, this one should be on every teacher's shelf.

Lovins, Amory B. Soft Energy Paths: Toward a Durable Peace. Ballinger Pub. Co., 17 Dunster St., Harvard Square, Cambridge, MA 02138, 1977, $6.95. This insightful and controversial book presents alternatives to current patterns of energy excesses and waste. Changes in decisions on how to obtain and use energy are advised as prelude to a safe, agreeable future. Information on costs and commentary on values clarify the "soft path" position. For adults.

Lovins, Amory B. World Energy Strategies. Ballinger Pub. Co., 17 Dunster St., Harvard Square, Cambridge, MA 02138, 1975, $4.95. This is a basic source of facts, issues, and options that should be read by anyone seriously interested in the energy debate and decision-making. Choices among energy sources are presented in an understandable

but technical manner. The type of society we'll have in the future, however, depends on how much energy we think we need. Recommended for teachers.

Lovins, Armory B. and Price, John. Non-Nuclear Futures. Ballinger Pub. Co., 17 Dunster St., Harvard Square, Cambridge, MA 02138, 1975, $5.95. This influential work outlines concisely the main technical grounds for ethical, social, and economic concern about nuclear power in a way understandable to most people without technical training.

Lucas, Ted. How to Use Solar Energy in Your Home and Business. Ward Ritchie Press, Pasadena, CA, $8. Includes solar heating and cooling, electric cars, and wind systems.

Mazria, Edward. The Passive Solar Energy Book. Rodale Press, Emmaus, PA, 1979, $10.95. This comprehensive volume is two books in one. It is a primer on the fundamental concepts of heat transfer by solar energy and on its practical applications illustrated by photographs and performance data of many passive solar buildings. It is also a workbook containing step-by-step instructions on designing and sizing passive solar heating systems and how to calculate heat losses and gains, performance measures, and cost effectiveness. Excellent graphics support the clear, nontechnical language of the text. Yet there is plenty of data and basic formulae to provide practical assistance to the physical science or industrial arts teachers who want to know more of the how and why of solar energy transfer and storage.

Merrill, Richard and Gage, Thomas, eds. Energy Primer. New York: Dell Publishing Co., 1978, $7.95. This updated sourcebook is a catalog of information and sources of plans and materials for use of renewable forms of energy--sun, wind, water, and biofuels. Emphasis is on homes and small-scale systems suitable for families or small communities. Many illustrations and concise factual reports sprinkled throughout. The large-scale paperback format invites student browsing. Suggestions for items to build are numerous.

Murray R. Nuclear Energy: An Introduction to the Concepts, Systems, and Applications of Nuclear Processes. 1975, Pergamon Press, Elmsford, NY 10523, $14.50. Text cited as one of the most popular reference materials used by science teachers in North Carolina.

Pierotti, A., Keeler, A., and Fritsch, A. Energy and Food. revised, 1977, available for $6.90 from Citizens' Energy Project, 1110 - 6th St., N.W., #300, Washington, DC 20001. The authors outline energy used in production, processing, delivery, and marketing of selected food items and suggest some ways to reduce this consumption. Energy "costs" of beverages and some other common processed foods are specified.

Rothchild, John and Tenney, Frank. The Home Energy Guide: How to Cut Your Utility Bills. New York: Ballantine Books, 1978, $1.98. This is a very readable and portable paperback full of practical suggestions. A bargain!

Schmidt, F. H. and Bodansky, David. The Energy Controversy: The Fight Over Nuclear Power. 1976, Albion Pub. Co., 1736 Stockton St., San Francisco, CA 94133, $7.95 ($4.95 ppbk). This has been a very popular reference work for science teachers.

Stobaugh, R. and Yergin, D. Energy Future, Report of the Energy Project at the Harvard Business School. Random House Inc., 201 E. 50th St., New York, NY 10022, 1979, $12.95. Considering the limited prospects of other energy strategies, the authors argue for solar energy and conservation. Further, they advocate decentralized power as requiring less capital investment and producing quicker results. Comprehensive and highly readable.

Wilson, Mitchell. Energy. rev. ed. Life Science Library, Morristown, NJ: Time-Life Books, 1970, $7.95. This volume of the Life Science Library is a comprehensive, heavily illustrated book which examines energy from Galileo's discoveries to the laser beam. Sources of energy, measurement of energy, and each form of energy are discussed with the clarity typical of this series. One picture essay surveys the history and production of oil; other essays cover electrical phenomena, the power of the atom, and future power sources. A chronology recounts the history of atomic energy.

BOOKLETS

ABC's of Radiation. 1977. It is a free, 28-page booklet available to individuals sending a request to Public Affairs, Brookhaven National Laboratory, Associated Universities, Inc., Upton, NY 11973. This is clearly presented basic information about radiation from radioactive materials and nuclear reactors: definitions, measurements, risks, safety practices, and controls. Originally written for employees of a large laboratory using nuclear energy. The reading level is appropriate for advanced upper elementary students.

Basics of Solar Air Systems. It is from the Sheet Metal and Air Conditioning Industry, 1900 L St., NW, Suite 405, Washington, DC 20036. No charge. Elementary description of solar air systems, well illustrated.

Colder . . . Darker (analysis of FEA-sponsored National Survey of Household Energy Use) and Save Energy, Save Money (inexpensive conservation, insulation techniques) booklets available free from: Community Services Administration, Office of Energy Program, 1200 - 19th St., N.W., Washington, DC 20506.

Cooperative Extension, New York State, Save Energy, Save Dollars, available for $1.50 from Mailing Room, 7 Research Park, Cornell University, Ithaca, NY 14853. This collection of articles offers practical advice to homeowners, prospective homeowners, and consumers on ways to conserve energy in daily living.

Department of Energy (DOE) energy education materials are available free of charge from: U.S. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Ask for current list of

their many titles. Order in advance; two months waiting time for delivery is typical. Some representative titles are:

Careers in Energy Industries
Energy in Focus: Basic Data
The First Reactor
Flywheels: Storing Energy as Motion
Gas Mileage Guide for New Car Buyers
How to Save Money by Insulating Your Home
How to Understand Your Utility Bill
Nuclear Energy
Nuclear Power in Space
Nuclear Power Plant Safety
Sixty-Five Ways to Save Natural Gas
Solar Energy for Heating and Cooling
Tips for Energy Savers
Tips for the Motorist: Don't Be Fuelish

Department of Housing and Urban Development. In the Bank or Up the Chimney, U.S. Government Printing Office, Washington, DC 20402, Stock No. 023-000-00297-3, $1.70. This booklet is an elaborate worksheet that allows homeowners to compute costs and benefits of storm windows, insulation, weatherstripping, and other energy-saving practices. It requires 2-3 hours to complete, but provides much worthwhile information and exercises math skills at the same time.

Department of the Interior, Geological Survey. Natural Steam for Power is an illustrated fold-out brochure on one kind of geothermal power. Cost: 25¢ from U.S. Government Printing Office, Washington, DC 20402, Stock No. GPO-19740-548-685.

D.P.I., Energy Conservation in School Facilities. Iowa State Department of Public Instruction, Grimes State Office Bldg., Des Moines, Iowa 50319. Brochure lists specific recommendations for reducing energy waste in school buildings.

Eaton, William W. Energy Technology, Energy Storage, Geothermal Energy, Oil, and Solar Energy are all available free from DOE, Technical Information Center, Box 62, Oak Ridge, TN 37830. Multiple copies for classroom use will be mailed on request. Ask for a current listing of other free publications on a wide range of energy topics.

Edelson, Edward. Alternate Energy Sources is one of many useful free booklets provided to teachers by Edison Electric Institute, 90 Park Avenue, New York, NY 10016.

Energy, A Growing National Problem. Education Servicing Section, National Wildlife Federation, 1412 Sixteenth St., NW, Washington, DC 20036. Single copy free; additional 20¢ each; 50 or more, 16¢ each. The illustrated, 16-page report discusses our energy problem and solutions.

The Good News About Energy is a 49-page report of a 1979 study by the Council on Environmental Quality. It is available from the Executive

Office of the President, Council on Environmental Quality, 722 Jackson Place, N.W., Washington, DC 20006. The potential for achieving lower energy growth in the United States and the implications for the economy, the environment, and government policy are discussed.

How to Save Gasoline . . . and Money is an 8-page pamphlet on efficient driving practices. Available free from DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Ask for a list of currently available publications on energy-related topics.

Iowa Energy Policy Council. Home Energy Savings Manual is a well-written booklet that provides basic energy conservation measures for the home. It has about 75 pp. and is free. It is available from the Iowa Energy Policy Council, Capitol Complex, Des Moines, IA 50319.

Iowa Power. A series of "Q and A" booklets were developed using a format of questions and answers to discuss the content. Titles are: Gas Safety, Gas Supply, Utility Regulation, Electric Safety, Electric Supply and Profit. Each booklet is about 5 pages in length and is available to customers in the Iowa Power and Light service area in central and southwest Iowa through the local utility office.

Miller, Alan S., et al. Solar Access and Land Use: State of the Law 1977, free, from the National Solar Heating and Cooling Information Center, P.O. Box 1607, Rockville, MD 20850. This is a summary of solar access rights for various buildings depending on solar input for comfort and is part of a larger study, Legal Barriers to Solar Heating and Cooling of Buildings.

Olin, Hubert L. Coal Mining in Iowa, State Mining Board, State of Iowa, Des Moines, Iowa 50319. Early history of coal mining in Iowa and role of coal in development of the state's economy are presented.

Solar Energy - Progress and Promise. Executive Office of the President, Council on Environmental Quality, 722 Jackson Place, NW, Washington, DC 20006. The 42-page booklet discusses progress in the development of various aspects of solar energy utilization.

Your Energy World. Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. This 1977 publication is for grades 4-6 and is free.

TEACHER AIDS

American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209, will send teachers free copies of their educational services newsletter, Natural Gas Energy. Reading level is adult. Each issue focuses on one topic. For example, Volume 8, No. 2 is devoted to "Fuels from Biomass." Other recent issues centered on "Synthetic Natural Gas from Peat," "Coal Gasification," "Natural Gas and the Environment," "Energy Balances." Free kits are available such as: Natural Gas Serves Our Community Kit for grades 4-5 or grades 2-3. A booklet is also offered by the title Natural Gas Serves Our Community Booklet for grades 2-3 or 4-5. Additional free booklets are:

Natural Gas - Science Behind Your Burner
Experiments: Properties of Gas and Heat Energy
How Your Gas Meter Works
Look to the Future - The Gas Company in Your Community
History of Natural Gas
The Story of Natural Gas Energy

Carey, Helen. Award Winning Energy Education Activities for Elementary and High School Teachers. 1977, available at no cost from DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

CEL Blocks. Primary Interdisciplinary Environmental Learning Packets, Brevard County, FL. (ESEA Title III, Project #050-2323-73003). Student cards covering areas of environmental education which can be used by teachers in a variety of interdisciplinary ways.

Community Workers and the Energy They Use. National Science Teachers Association, (grade two), 1976, free. Available from DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

Curriculum for Appropriate Technology. National Center for Appropriate Technology, P.O. Box 3838, Butte, MT 59701. $5. The packet includes a selection of ten activities about present and future energy systems. Topics covered are: Energy Production and Use, Food and Nutrition, Renewable Resources, plus Cars and Recycling. Posters, handouts, and learning games are included.

Education Packets: Wind Conservation, Solar and Chemical Energy. Simple and well described projects are suggested for upper elementary students. Obtain from: American Museum of Atomic Energy, P.O. Box 117, Oak Ridge, TN 37830.

Edison Experiments You Can Do is available for 50¢ from the Charles Edison Fund, David O. Schantz, Curator, 101 South Harrison Street, East Orange, NJ 07018. This is a collection of seven booklets describing 75 experiments related to concepts of electricity. Alternative Energy Sources, Energy Conservation, Nuclear Experiments, and Environmental Experiments are among the topics included.

Energy. Environmental Education Project, ESEA Title III, Section 306 Topeka Public and Parochial Schools, 1601 Van Buren, Topeka, KS 66612 (ED 093 649). Objectives are listed, along with activities which meet the stated objectives. Teachers select only those appropriate to the objectives for their students.

Energy. Michigan United Conservation Clubs, P.O. Box 30235, Lansing, MI 48909. Provides information on the nature of energy, sources and uses of energy, and conservation. There are also some work sheets and ideas for helping others learn more about energy.

Energy. Social Issues Resource Series, Eleanor C. Goldstein, 1975. Social Issues Resource Series, Inc., 1200 Quince Orchard Boulevard, Gaithersburg, MD 20760. Notebook filled with reprints of articles related to energy.

Energy Activities for the Classroom - 1976. Coon, Herbert L. and Michele Y. Alexander, 1976. ERIC Center for Science, Mathematics and Environmental Education College of Education, the Ohio State University, 1200 Chambers Road, Third Floor, Columbus, Ohio 43212. Resource booklet of energy teaching activities divided into grade levels: K-3, 4-6, 7-9, 10-12.

Energy Conservation Classroom Kits 1-3, 4-6. Southern California Edison Company, 1976. Educational Services, Room 397, P.O. Box 800, Rosemead, CA 91770. Colorful kits to help teachers teach about energy conservation. There are folders, inspector cards, stickers, certificates. The teacher's guide contains ideas and lesson plans, in addition to duplicating masters.

Energy Crisis Teaching Resources. Curry, Wendell, et. al., Oregon State Board of Education, Salem, OR, 1973, 59 pp. (ED 085 316). Many very useful activities to be used in stressing individual responsibility towards energy crisis problems.

The Energy Crisis: What You Can Do About It. Standard Oil Company (Indiana), 1973. Mail Code 3705, 200 E. Randolph Drive, Chicago, IL 60601. Folder containing four spirit masters and specific teaching instructions. The spirit masters give information and ask for students to supply some interpretation. Parents and other adults are encouraged to participate.

Energy Education Activities for Elementary and High School Teachers. National Science Teacher Association, 1724 Connecticut Ave., NW, Washington, DC 20036. 1978, Free.

Energy - Environment Materials Guide. Mervine, Kathryn E. and Rebecca E. Cawley, National Science Teachers Association, Washington, DC, 1975, (ED 111 663). Handy source book containing annotated bibliographies for teachers, students. Non-print material.

Energy - Environment Mini-Unit Guide. Smith, Stephen M., ed., 1975. National Science Teachers Association, Washington, DC, (ED 111 664). Materials designed to stimulate decision making in young children and to make teaching more interdisciplinary. It is filled with many activities and guidelines.

Energy and Man's Environment. Jones, John, D.Ed., Editor, 1976. Energy and Man's Environment, Inc., 0224 S.W. Hamilton, Suite 301, Portland, OR 97201. Interdisciplinary teacher's guides to energy and environmental activities. Involves 8 books - Activity Guide, Uses of Energy, Sources of Energy, Impacts of Energy, Limits of Energy, Conversion of Energy, Future Sources of Energy, Glossary.

Energy and Man's Environment - Activity Guide. Ris, Thomas F. Energy and Man's Environment, 2121 Fifth Avenue, Seattle, WA 98121, (ED 106 070). Provides educational strategies and materials needed for introducing energy to all grade levels on an interdisciplinary basis. Each chapter has four themes: (1) Scientific, (2) Ethical, (3) Aesthetic, (4) Utilitarian.

Energy for Today and Tomorrow. San Diego City/County Schools Energy Education Committee Department of Education, San Diego County, 6401 Linda Vista Road, San Diego, CA 92111, 1975. Activities for students in grades kindergarten through six. These help to create an awareness of the need of dealing with energy problems.

Energy is Basic is a free information pack from the Energy Action Office, Westinghouse Nuclear Fuel Division, P.O. Drawer R, Columbia, SC 29250.

The Energy Show. The New Western Energy Show, 226 Power Block, Helena, MT 59601. It is a script for a puppet or acting show. $3.50

The Energy We Use. National Science Teachers Association, (grade one), 1976, free. Available from DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

Environmental Education: Strategies for Wise Use of Energy. Division of Science Education, North Carolina Department of Public Instruction, Raleigh, NC 27611, c. 1974. Designed for use at all grade levels, therefore, activities are grouped K-3, 4-6, 7-12. An appendix contains charts, glossary, bibliography, checklists.

Get Your Hands on Energy. The New Western Energy Show, 226 Power Block, Helena, MT 59601. A collection of simple, practical, "hands on" projects deals with energy concepts. $3.50.

Living Within Our Means: Energy and Scarcity. Environmental Educational Instructional Activities K-6, The University of the State of New York, The State Education Department, Albany, NY 12234. Instructional manual which illustrates ways in which environmental concerns may be integrated into the curriculum. Excellent activities arranged according to disciplines.

Mickey Mouse and Goofy Explore Energy. Walt Disney Productions, 1976. Public Affairs Department, EXXON, U.S.A., P.O. Box 2180, Houston, TX 77001. Very comprehensive, yet delightfully presented energy comic book. Copies are available from the above address. Covers previous sources of energy and possible future sources.

Nineteen Fact Sheets On Alternative Energy Sources. (1977) Sheets include wind; bioconversion; solar, ocean, geothermal, and nuclear power; coal-derived fuels; conservation; energy storage; environmental impacts; a glossary and a bibliography are also results of NSTA/DOE cooperation. The sheets are available from the Department of Energy, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. The materials were prepared by the National Science Teachers' Association.

North Carolina DPI, The Energy Conserver, available on request from the Division of Science Education, Room 284 Education Building, Raleigh, NC 27611, is a monthly newsletter full of tips on energy and schools, conservation projects, and classroom activities.

Student Learning Activity Module "The Energy Crisis". Hughes, Judi and Lee County Environmental Education Program, Title III ESEA, 2266 Second Street, Fort Myers, FL. Contains lesson plans, resource materials, and a Student Teaching Module on energy. Developed to help create an awareness of the causes, and some solutions for the energy crisis the world is facing.

A Teacher's Guide For Energy Conservation. Contact: Jonathan Wert, Environmental Center, University of Tennessee, South Stadium Hall, Knoxville, TN 37916.

A Teacher's Handbook on Energy. Interstate Energy Leadership Project, Colorado Department of Education, 201 E. Colfax Ave., Denver, CO 80203.

Ways to Environmental Education; Volume III, Allen, Rodney F., Ed. and Others. Florida State University, Tallahassee College of Education, Tallahassee Junior Museum, FL, 1975, 150 pp. Ten environmental booklets in one volume. One booklet covers energy learning activities for camp and home.

Wide World of Energy Kit. Walt Disney Productions, 1976, Walt Disney Educational Media Company, 500 South Buena Vista Street, Burbank, CA 91521. Kit contains cassette and color filmstrip titled, "The Search for Power and Energy;" 18 full-color study prints; Energy Game; 30 copies of the energy comic book, "Mickey Mouse and Goofy Explore Energy;" 10 energy activity cards; teacher's guide with information and additional activities.

PERIODICALS

ALTERNATIVE SOURCES OF ENERGY features articles on many aspects of alternative technologies and is a clearinghouse for practical ideas on energy sources. Bi-monthly, $10/yr. from Alternative Sources of Energy, Inc., Route 2, Box 90A, Milaca, MN 56353.

CURRENTS is a survey of solar legislation, research, workshops, and alternative energy issues in Iowa. Published by Citizens United for Responsible Energy, 3500 Kingman Blvd., Des Moines, IA 50311 at $5/year.

EARTH JOURNAL, published quarterly, regularly features energy-related subjects. Costs $3/yr. from Minnesota Geographic Society, P.O. Box 6181, Minnehaha Sta., Minneapolis, MN 55406.

ENERGY AND EDUCATION, a bi-monthly newsletter is available free from NSTA, 1724 Connecticut Ave. NW, Washington, DC 20036. It features energy facts and news of educational programs across the country.

FREE ENVIRONMENT NEWSBRIEFS. Published eight times per year by Free Environment, Inc., Activities Center, Iowa Memorial Union, Iowa City, IA 52242 - $2. Deals with all types of environmental issues.

IOWA ENERGY BULLETIN. Published monthly by Iowa Energy Policy Council, 215 East 7th Street, Des Moines, IA 50319 - no charge. A survey of Iowa energy and conservation issues.

IOWA SCIENCE TEACHERS' JOURNAL, a quarterly, is available free to science teachers requesting it on the school letterhead, c/o Managing Editor, ISTJ, Iowa Academy of Science, University of Northern Iowa, Cedar Falls, IA 50613. Volume 16, No. 1 (April 1979) focused on energy, with Iowa-specific information.

MOTHER EARTH NEWS is romantically "back to the land." It has interesting articles on unusual homes, low-energy life styles, recycling and bartering, "do-it-yourself" everything.

PEOPLE AND ENERGY is published monthly by Citizens' Energy Project, 1413 K Street NW, 8th Floor, Washington, DC 20005, $10. News of citizen action on energy and appropriate technology.

SCIENCE NEWS has weekly articles on energy research and technology.

MULTI-MEDIA MATERIALS

16 mm films, filmstrips, video cassettes and posters: The following items are a small, selected sample of the materials available on ENERGY.

For a broader listing of resources available to you at low or no-cost, contact your AEA, the media center of the nearest university, and the organizations listed in this publication. Also recommended is an excellent film bibliography, bound for library use and arranged by topics (What is Energy? Energy Issues and Options, Energy and the Environment, Energy Conservation, Sources of Energy). It is available at cost, $3, from New York State Alliance to Save Energy, 36 W. 44th Street, Room 709, New York, NY 10036. Ask for Energy on Film.

Filmstrips referred to in the ECAP's can be borrowed from your local AEA. In 1978, the AEA's received five sets of filmstrips. Some may have been sold to individual districts. Contact the DPI Energy Consultant if you are unable to locate a filmstrip through the AEA media center.

THE AMERICAN DREAM IS RUNNING OUT OF FUEL. 18 minutes, color, $230 or $19-rent (grades 5-8). Films, Inc., 1144 Wilmette Avenue, Wilmette, IL 60091.

American Gas Association, Dept. I-14, 1515 Wilson Blvd., Arlington, VA 22209, furnishes free 35 mm filmstrips. NATURAL GAS--SCIENCE BEHIND YOUR BURNER shows how gas gets from well to burner and comes with wall charts and worksheets. Other titles include, FUEL CELLS, HOW THE JET ENGINE WORKS, LOOK TO THE FUTURE, MORE TO COME (estimates of energy resources underground), SCIENTISTS WORK TOGETHER (case study of a fuel cell research project). Free films for teachers are available from the same source. ENERGY traces sources from the first fires to atomic power, outlines problems and proposes some solutions.

Association Films, Inc., 866 Third Avenue, New York, NY 10022 lends 16 mm movies free of charge. Examples of titles are MIRRORS OF TIME about a research ship exploring the ocean floor in search of gas and oil deposits; THE ENERGY BRIDGE about coal's potential to bridge the fuel resource gap; KING ZOB AND THE ENERGY CRUNCH about space heating and cooling conservation possibilities; UNSEEN JOURNEY about transporting crude petroleum.

BATE'S CAR: SWEET AS A NUT. 16 minutes, 16 mm, color, $230 or $30-rent, 1975 (grades 5-12). Arthur Mokin Productions, 17 W. 60th Street, New York, NY 10023. Presents the inventor's energy-saving inventions, particularly his methane-driven automobile. Highly recommended by AAAS.

COALMINING: THE STORY OF BURIED SUNLIGHT. Filmstrip #1, Part A, elementary, grade 5. Available through the local AEA.

Citizens' Energy Project, COMMUNITY SELF-RELIANCE POSTER, 1979, $4, from Citizens' Energy Project, 1413 K Street, 8th Floor, Washington, DC 20005. This colorful graphic displays a self-reliant community basking under the sun. Rehabilitated homes, bike paths, urban gardens, greenhouses, and a community health clinic are featured projects. Flip side lists resource people and other information.

CONSERVE YOUR ENERGY, a family energy diet kit (includes booklet, score card, poster) is available for $2 from Associated Press, 50 Rockefeller Plaza, New York, NY 10020.

C.U.R.E. (Citizens United for Responsible Energy) produced SOLAR ENERGY IN IOWA, a 22-minute slide show in 1977 which covers the basic principles of solar as well as projects in and near Iowa. A cassette and script is included. Rental for contribution from C.U.R.E., 3500 Kingman Blvd., Des Moines, IA 50312. 515/277-0253.

DOE Technical Information Center Film Library, P.O. Box 62, Oak Ridge, TN 37830, provides teachers with an annotated brochure on free energy films for classroom use. Write for your copy. Some titles that Iowa teachers have used and liked are LOOK TO THE SUN; SUN POWER FOR FARMS; THE ULTIMATE ENERGY and TO BOTTLE THE SUN (on fusion's potential); PUTTING THE SUN TO WORK (showing an innovative home); ENERGY, THE AMERICAN EXPERIENCE (which illustrates the historical relationship between economic growth, industry, and energy sources); CHALLENGE OF THE FUTURE; ON THE MOVE (about packing and shipping radioactive materials); POWER FROM THE EARTH (concerning geothermal energy); UP THE POWER CURVE, on conservation, covers a wide range of energy-saving ideas and estimates and savings from each; WORLD BEHIND YOUR LIGHT SWITCH tells in a non-technical way the story of production, transmission, and use of electricity.

ECOLOGY ACTIVITY CARDS are available from: BFA Educational Media, 2211 Michigan Avenue, Santa Monica, CA 90404. Some of the activities are related specifically to energy. Others in the box guide the children towards conservation and the idea of using our resources wisely.

ECOLOGY: UNDERSTANDING THE CRISIS is available from: Series No. 6454, c. 1972. Encyclopedia Britannica Educational Corporation, 425 North Michigan Avenue, Chicago, IL 60611. Filmstrip, records, guides generally cover what has caused the crisis, how man relates to his environment, plus a look into the future.

ENERGY: A FIRST FILM. 8 minutes, sound, color (grades K-3), BFA Educational Media, 2211 Michigan Avenue, Santa Monica, CA 90404.

ENERGY: ABILITY TO DO WORK. 9 minutes, color, sound (grades 5-8), AIMS Instructional Media Service, P.O. Box 1010, Hollywood, CA 90028.

ENERGY ALTERNATIVE OR FUTURE SOURCES OF ENERGY. Filmstrip #2, elementary grade 6. Available through the local AEA.

ENERGY AND ITS FORMS. U 25547, CORF-1961, 11 min. b/w, $5.60. Explains the basic concept of energy and shows examples of its principal forms, including nuclear energy. Introduces the idea of changing energy from one form to another to do work, and outlines the way in which plants convert the energy of the sun to chemical energy to provide a basic source of food and fuel. See "Iowa Films" listing for ordering information.

ENERGY AND WORK. US 25686, EBEC-1962, 11 min., color, $6.80. Explains through simple experiments that energy is neither created nor destroyed, but simply changed from one form to another. Illustrates a variety of these transformations and explains them in simple terms. See "Iowa Films" listing for ordering information.

THE ENERGY CHALLENGE - Kit, c. 1975. Pollution Control Education Center, Township of Union Public Schools, Union, NJ. Grade level undesignated, however, could be used in grade 6 with some modification and for the junior high. Contains student booklets, teacher's guide, two filmstrips with cassette, duplicating masters, activity cards, and overhead transparencies.

ENERGY CRISIS. U 30217, JOU-1972, 12 min., color, $8.30. Reviews our sources of energy and the length of time they may remain available. A hydro-electric plant, a conventional steamdrive electrical power plant and a nuclear power plant display how each generates power and its limitations. Concludes with possible solutions such as the "Fast Breeder Reactor" and "Fusion Reactor" which may someday provide unlimited power. See "Iowa Films" listing for ordering information.

ENERGY CRISIS GAME. 1973 (Upper elementary and junior high), Intemation, Inc., New York, NY 10001. For 2-6 players.

ENERGY DOES WORK. U 25548, CORF-1961, 11 min., b/w, $5.60. Billy, surprised to learn that when he is playing, he is doing work, is shown, by means of examples intended to appeal to the young child, that work is done whenever something is moved, that energy can be stored, and that food supplies energy to our bodies. See "Iowa Films" listing for ordering information.

ENERGY GAME. Northern Natural Gas produced a twenty minute slide-tape show followed by a quiz, designed for grades 4-6. The stress is upon energy conservation with a short review of where energy comes from. The kit is available through Northern Natural Gas, 503 Shops Bldg., Des Moines, IA 50309. 515/288-7463. No charge.

ENERGY HISTORY OF THE UNITED STATES 1776-1976 is a large, colorful wall poster for classroom use. Cost: $2.05 from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, Stock No. 052-010-00459-0.

ENERGY IN IOWA. Filmstrip #1, Part B, elementary grade 5. Available through the local AEA.

ENERGY: PAST AND PRESENT, and ENERGY: FUTURE SUPPLY AND COSTS are slide-tape sets available free from Iowa State Extension Service. Call the county extension office to borrow copies.

ENERGY WITH A CAPITAL C - FOR CONSERVATION. Energy Policy Council, 707 East Locust, Des Moines, IA 50319. Slide presentation comes complete with slides, audience pamphlets, and a recorded cassette of the slide narrative.

FIRST FILM ON THE WIND. 9 minutes, 16mm, color, sound, c. 1966, (Elementary), BFA Educational Media, 2211 Michigan Avenue, Santa Monica, CA 90404. Shows how, though one cannot see the wind, he can see what the wind does, such as making waves on the water, swaying trees, and lifting kites. Shows how rain clouds come and go with the wind.

Iowa Films. Films listed as "Iowa Films" can be ordered by phone, by mail, or in person. (Collect calls accepted from Iowa.) Ask for film scheduling. The two locations of film centers are:

University of Iowa	Iowa State University
Media Library	Media Resources Center
C-5 East Hall	121 Pearson Hall
Iowa City, IA 52242	Ames, IA 50011
319/353-5885	515/294-1540
Hours: 8:00-5:00	Hours 7:30-12:00
	1:00-5:00

Price list is the charge for three day rental. You are responsible for return postage. A written purchase order is required before shipment from the media resource person or business office of your school.

Iowa Energy Extension Service has several audio-visual resources available on energy conservation for no charge except return postage. Order from: Iowa Energy Extension Service, Iowa State University, 110 Marston Hall, Ames, IA 50011.

Films:

* THE GREAT ADVENTURE

A 30-minute color sound 16 mm production showing the potential for solar energy, emphasizing a variety of applications including

wind and the making of fuels from biomass products. Eddie Albert narrates. 1979. For general use. Produced by Department of Energy.

* A CITY FARMSTEAD

15 min., 16 mm color. Shows how one urban house uses solar, waste recycling and food production.

Slide Shows:

* PASSIVE SOLAR ENERGY

Six separate slide shows of 20 slides each on the following topics: general, direct gain, conservation aspects, thermal storage walls, attached greenhouses, water heating and roof ponds. Pictures and projects mostly from New Mexico. Developed by Dr. J. D. Balcomb. Script included.

* THE SOLAR QUEST

87 slides, 11 minutes, color. Documents how solar is being tapped for practical use in homes. Includes underground. Produced by The Polished Apple. Also available in filmstrip. Cassette tape accompanies. For general use.

* ENERGY FOR RURAL IOWA

20 minutes. Discusses research projects at Iowa State Univesity. #S851. Can be ordered through Media Resources. Includes wind, research house, alcohol, methane. Produced in 1979.

Living History Farms. SEEDS OF SURVIVAL, a 28-minute film portrays American farming of pioneers, and farmers in the 1900's and today. Energy reliance and sources are evident. The film is available for $3 from: The Grinnell Mutual Reinsurance Company, Public Relations Department, Grinnell, Iowa 50112; or Living History Farms, R.R. 1, 2600 NW 111th St., Des Moines, IA 50322.

MAN'S SEARCH FOR ENERGY. Filmstrip, 36 frames, $6.75, (grades 5-8), McGraw-Hill Films, 1220 Avenue of the Americas, New York, NY 10020.

Modern Talking Picture Service, 2323 Hyde Park Rd. New Hyde Park, NY 11042, offers a variety of free films produced by major industries as public relations/education efforts. Most of them are very professionally done; many are cinematic award winners. Write to the above address for their free lists. (Films are shipped from the Modern Library in Cedar Rapids.) A few of their other energy-centered movies available to junior and senior high schools are: WITHIN THIS EARTH, A MATTER OF ENERGY, MINING AND THE ENVIRONMENT, ENERGY VS. ECOLOGY, THE GREAT DEBATE, NUCLEAR ENERGY FOR TODAY AND TOMORROW, OFFSHORE, REFINERY, ENERGY IN PERSPECTIVE.

THE PETRIFIED RIVER. Film available from Iowa Electric Light Company.

RHR Filmedia, Inc., 1212 Avenue of the Americas, New York, NY 10036 will lend (free) the 16 mm color film, A QUESTION OF VALUES. This is the story of a small town's intense debate over potential benefits and dangers of a new oil refinery. Also, free on loan from the same source, THE HIDDEN ENERGY CRISIS explains that energy shortages may reduce supplies of petrochemicals commonly used in clothing, shelter, and food, and DOUBLE UP AMERICA explains benefits of carpooling.

Rienow, Robert. DARKNESS FOR OUR CITIES is an audiotaped plea for wasteful Americans to change their ways. It would be a useful introduction to an energy or conservation unit. Students will hear many possibilities for further research. Available for $14.95 from Center for Cassette Studies, Inc., 8110 Webb Avenue, North Hollywood, CA 91605.

Shell Oil Company Film Library, 1433 Sablier Circle West Drive, Indianapolis, IN 46239 will send you a list of films available on free loan. Some energy-related offerings are: THE FOSSIL STORY which emphasizes significance of fossils in the search for oil deposits; THIS LAND which explores the natural resources of North America, including oil and coal, and how they were formed; OIL, OIL WELL, and REFINERY PROCESSES which depict the source and processing of American's favorite fuel; and FOOD OR FAMINE which illustrates methods of improving agriculture around the world.

Union Carbide Corporation, Public Affairs, 1730 Pennsylvania Avenue NW, Washington, DC 20006 will provide a free wall chart listing nearly 500 NON-FUEL USES FOR OIL.

U.S. Department of Commerce, Office of Energy Programs, Room 3011, Washington, DC 20230 will lend (free) the 16 mm color film on ENERGY: CRITICAL CHOICES AHEAD, a discussion of energy supply and demand through the year 2000.

ORGANIZATIONS AND RESOURCES

If you have the energy to write a few letters on school stationery, the following organizations will fill your mailbox with free or low-cost information on energy topics.

American Gas Association, 1515 Wilson Blvd., Arlington, VA 22209 has an energy newsletter, films, ditto masters, and a variety of free literature free to teachers who request them on school stationery.

American Petroleum Institute, Information Service Department, 2101 L Street NW, Washington, DC 20006 provides an abundance of colorful materials for classroom use, free on request, including movie loans.

American Public Gas Association, Watergate Office Bldg., 2600 Virginia Ave. NW, Washington, DC 20037 provides free educational materials on request.

American Wind Energy Association, 1621 Connecticut Avenue NW, Washington, DC 20009 will send a brochure of general information about windmills, an invitation to join the club, and a list of publications available on the subject of wind machines.

Area Education Agency (AEA) has films, filmstrips, book catalogs and other resources for energy education. Contact the nearest one.

Association of Home Appliance Manufacturers, 200 N. Wacker Drive, Chicago, IL 60606 provides free "Energy Data" on typical operational costs of home appliances.

Atomic Industrial Forum, Public Relations Department, 7101 Wisconsin Avenue, Bethesda, MD 20014 will send information on nuclear power plants, including black-and-white graphics (for easy reproduction) diagramming various types of reactors.

Chamber of Commerce may be able to help locate solar buildings, alternative energy-related businesses, knowledgeable members of the community who may cooperate on an energy project for the class.

Citizens' Energy Project, 1110 - 6th St., NW, #300, 8th floor, Washington, DC 20001 researches and publishes comprehensive, low-cost reports on dozens of energy resources. Write for current list of titles.

Citizens United for Responsible Energy (CURE) 3500 Kingman Blvd., Des Moines, IA 50311, Tel. 515/277-0253, maintains a roster of speakers on energy topics and publishes a newsletter that often features "solar successes."

Cooperative Extension Service, 110 Curtis Hall, Iowa State University, Ames, IA 50011 has many bulletins and pamphlets on energy conservation available for the asking. Write or call 515/294-4576.

Edison Electric Institute, Public Relations Department, 90 Park Avenue, New York, NY 10016, provides information on all forms of electrical generation and a series of useful handbooks of energy-related experiments for the classroom.

Energy and Education Action Center, Room 514, Reporters Building, 300-7th St. SW, Washington, DC 20202, serves as an information center and data distribution network centered on energy-education materials and conservation measures.

Energy Extension Service, 110 Marston Hall, Iowa State University, Ames, IA 50011, has information and programs for schools and communities. Write or call 515/294-4266 for an up-to-date list of services.

Energy Research and Information Foundation, 3500 Kingman Blvd., Des Moines, IA 50311. ERIF is a non-profit corporation to promote and conduct research and educational projects as well as to provide information. Programs include Energy Sources, Kill-A-Watt, and a Traveling Solar Display. Phone: 515/277-0968.

Environmental Action Foundation, The Dupont Circle Bldg., Suite 724, Washington, DC 20036 will send a resource guide on electric utility issues.

Environmentalists for Full Employment, 1101 Vermont Ave N.W. #305, Washington, DC 20005 has published Jobs and Energy ($2 for individuals) and Jobs and Energy Update (50 cents each), exploring the impact of energy use transitions and alternative energy sources on employment. They advocate conservation and diverse solar systems as the best answers to the related problems of unemployment and the capital drain made by corporate energy industries.

Ethyl Corporation produces an annual Ethyl Digest on an energy topic. Get a free copy by writing to Ethyl, Corporate Public Relations, 330 South Fourth St., Richmond, VA 23217.

Ideas and Information Center, Iowa-Illinois Gas and Electric Company, 1403 Kimberly Road, Bettendorf, IA 52722. Phone 319/326-7054. Educational materials and answers to specific questions on local utility rates, consumption patterns, and insulation guidelines.

Institute for Local Self-Reliance, 1717 - 18th St. NW, Washington, DC 20009. This non-profit educational and research group explores possibilities of urban communities becoming productive, self-reliant systems. Write for their list of publications on topics like "A Neighborhood Energy/Food/Waste System," "Dawning of Solar Cells," "Neighborhood Power," and various food production concerns.

International Solar Energy Society, American Section, 12441 Parklawn Drive, Rockville, MD 20852 maintains a bibliography of solar and other renewable energy sources.

Iowa Academy of Science, University of Northern Iowa, Cedar Falls, IA 50613 publishes the quarterly Iowa Science Teachers Journal. The April 1979 issue featured several energy-education articles including "Wind Energy in Iowa." This one issue is available free to science teachers using school stationery for their request to the Editor, ISTJ. Subscription rate is $4/year.

Iowa Center for Local Self-Reliance, 3500 Kingman Blvd., Des Moines, IA 50311. The center is trying to research, demonstrate and educate the public about technologies and social structures which lead to self-reliance such as solar energy, energy conservation, organic gardening, recycling, and water conservation. Demonstrations, pamphlets, programs and consultations are offered. Phone: 515/277-0968.

Iowa Energy Policy Council, Lucas Bldg., Capitol Complex, Des Moines, IA 50319 has up-to-date information on energy use in Iowa and booklets on a variety of energy topics. Hotline: 515/281-4306.

Iowa Solar Office, Iowa Energy Policy Council, Capitol Complex, Des Moines, IA 50319 has solar energy information and materials including publications, films, a speakers bureau, consumer materials and lists of Iowa solar businesses and architects. Phone: 800/532-1114.

Iowa Solar Energy Association, 1433 Wildwood Drive, Cedar Rapids, IA 52402, 319/365-6103 may be able to provide you with resource persons who are knowledgeable about solar technology.

League of American Wheelman, 19 S. Bothwell, Palatine, IL 60067 provides information on ways and means of improving conditions for bicycling.

League of Women Voters of the United States, 1730 M Street NW, Washington, DC 20036 has a catalog of their own free or low-cost energy publications. Revised annually, this catalog is available from "Energy Department Publications" at the above address.

National Coal Association, 1130 Seventeenth Street NW, Washington, DC 20036, has articles, booklets, films, and other aids available on request that discuss the past, present, and future of coal.

National LP-Gas Association, 1800 North Kent St., Suite 1004, Arlington, VA 22209, provides free information about their products.

National Petroleum Council, Director of Information, 1625 K Street NW, Suite 601, Washington, DC 20006, provides free literature on various aspects of getting and using petroleum.

National Science Teachers Association, 1724 Connecticut Ave., NW, Washington, DC 20036 will send any teacher their bimonthly newsletter Energy and Education (free) plus a list of other energy publications.

National Solar Heating and Cooling Information Center, P.O. Box 1607, Rockville, MD 20850 publishes many handsome no-cost brochures and books, like "Passive Design Ideas for the Energy Conscious Consumer." You can call this group toll-free at (800) 523-2929.

National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 sells reprints of many otherwise-difficult-to-locate publications on a wide variety of energy topics. Write for a free list of publications.

National Wildlife Federation, 1412 - 16th St. NW, Washington, DC 20036 has conservation education publications and selected resource materials for developing energy education programs.

Public Interest Research Group, P.O. Box 19312, Washington, DC 20036 can provide information on Energy Alternatives.

Shell Educational Services, Shell Oil Company, P.O. Box 2463, Room 1541, One Shell Plaza, Houston, TX 77001 can provide energy education materials.

Sierra Club, Information Services, 1050 Mills Tower, San Francisco, CA 94104 will provide an Energy Packet for $1. This collection of articles includes "Solar Energy Now," and "Geothermal Energy" among several others.

U.S. Government Printing Office, Washington, DC 20402, offers many energy-related publications at prices from $1 to $10. Write to the above address and ask for Subject Bibliography Index and Price List 36 which contain information for selecting materials pertinent to energy-environmental issues.

Utility and/or Power Companies often have pamphlets and filmstrips, and sometimes posters, games, and lesson plans available to teachers.

Volunteers in Technical Assistance (VITA), 3706 Rhode Island Ave., Mt. Rainier, MD 20822 publishes technical bulletins on do-it-yourself technology including solar, hydro, and wind-powered projects. Bulletins are well illustrated, clearly written, and range in price from $1 to $6. Write for a free list of titles.

NON-RENEWABLE ENERGY SOURCES

Scrambled Word Puzzle

The following scrambled words are names for non-renewable energy sources. Unscramble them and write the words in the blanks.

1. ACLO _____
2. SAG LAURNTA _____
3. LECRTEITYIC _____
4. LIO _____
5. MTEPRUOEL _____
6. LISFOS SEFUL _____

ENERGY PUZZLE

C	O	N	S	E	R	V	A	T	I	O	N
U	S	R	E	C	Y	C	L	E	T	R	G
T	K	I	L	O	W	A	T	T	S	B	E
E	P	O	E	F	A	D	M	H	C	L	O
R	N	A	C	G	T	H	S	E	D	I	T
A	U	E	T	H	E	S	W	R	Q	G	H
T	C	V	R	V	R	S	D	M	F	H	E
I	L	N	I	G	C	F	O	A	A	T	R
O	E	Q	C	T	Y	O	R	L	O	N	M
N	A	M	I	W	U	S	U	N	A	C	A
I	R	E	T	E	X	S	S	J	K	R	L
N	L	P	Y	A	C	I	P	S	M	I	T
G	O	K	I	R	O	L	A	F	A	S	E
S	H	O	R	T	A	G	E	L	N	I	R
B	V	I	U	H	L	Z	B	O	U	S	N
L	G	L	D	R	C	S	F	W	R	L	A
P	E	N	V	I	R	O	N	M	E	N	T
V	I	H	F	V	H	U	R	U	D	O	I
W	O	O	D	E	J	R	F	P	E	M	V
J	O	Y	K	R	O	C	E	A	N	Q	E
D	S	Z	M	O	H	E	A	T	I	G	C

Find these words in the puzzle.

sun
crisis
wood
coal
gas
oil
geothermal
tides
wind
electricity
source
kilowatt
water
energy
solar
nuclear
thermal
recycle
environment
rationing
shortage
fuel
conservation
fossil
flow
manure
earth
heat
light
alternative
food
river
man
ocean

FUTURE LIFE STYLES

Choose one of the following situations and write about it. Be creative and use your imagination--but also remember to use what you have learned about energy.

Situation #1

Imagine you are writing in your diary. "It is the first day of the year 2000, and it seems ages ago that I was in school. So much has happened since then." (Go on to explain.)

Situation #2

Imagine you are age 47 in the year 2000 and are writing to your son. "You have criticized me and my generation for the mess we have made of the world." (What else would you say?)

WHAT HAPPENED

You have just come home from school. You turn on the radio, but nothing happens. You check the cord. No problem there, it's plugged in. Then you notice the clock has stopped. You check around the house and discover there is no electricity. A blackout. It has affected the whole neighborhood, the whole city. There is no indication of when the power will be restored. It may be off for days.

(Write a story describing what happened to cause it and now people reacted. What was life like?)

Energy Activities
Grade 6
Packet "A"
Master #5
Activity G, 1.3, 2.8, pg. 7

MY WEEKEND DIARY

In your diary, tell what you have done each day during the weekend. Remember, there is no bus, no car transportation, no heating or air conditioning, no TV, no phone. A diary is for keeping record of things you have done and feelings you have.

Friday

Saturday

Sunday

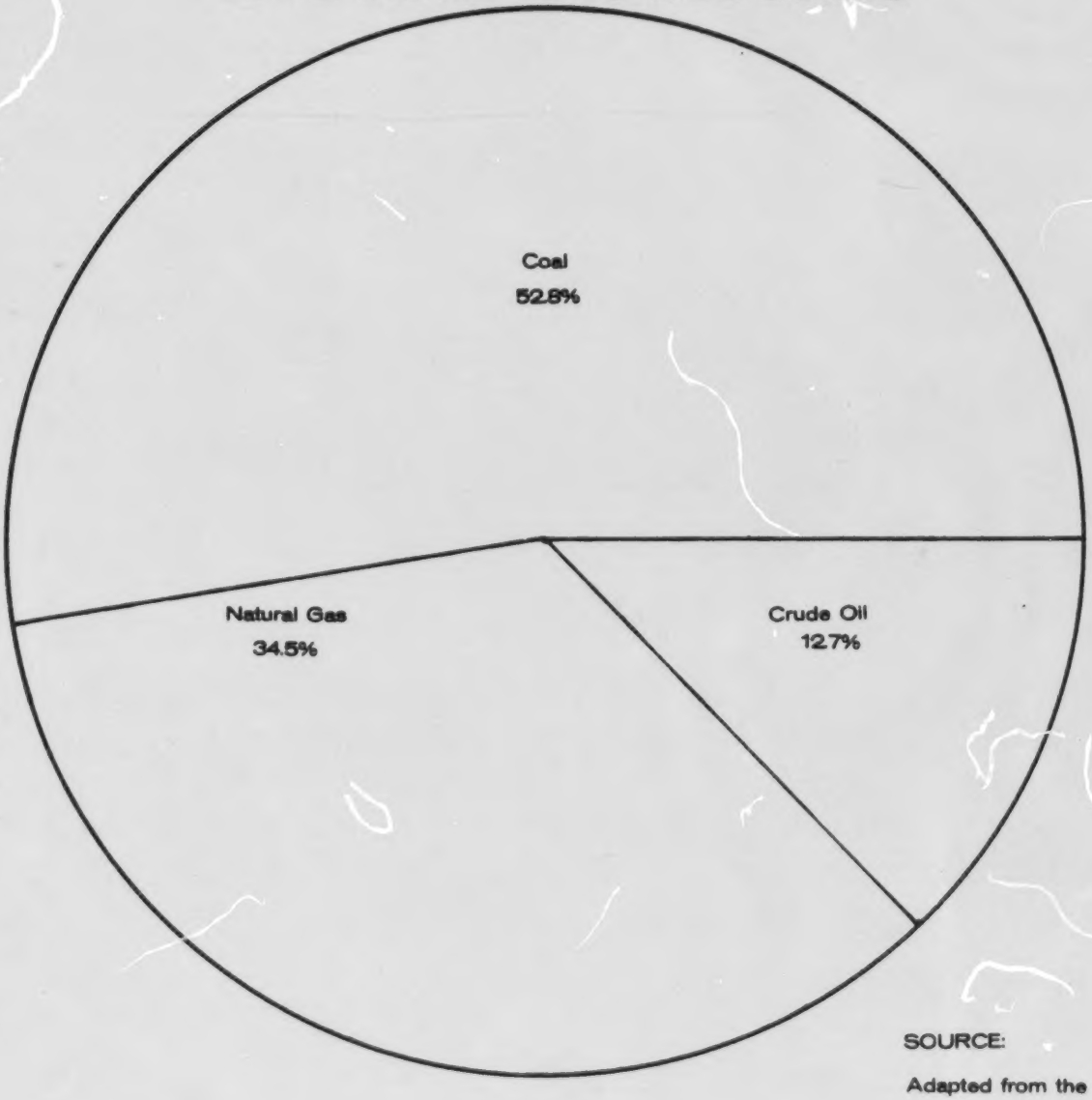
ENERGY AND LIVING CONDITIONS

	American Farm Family	Indian Farm Family
Working Hours		
Type of Lighting		
Education		
Water Source		
Diet		
Recreation		
Family Transportation		
Family Size		
Medical and Dental Care		
Energy Available		

Energy Activities
Grade 6
Packet "A"
Transparency #1
Activity D, 1.5, pg. 9

ESTIMATED WORLD SUPPLY OF FOSSIL FUEL

1974 AND 1979 FIGURES

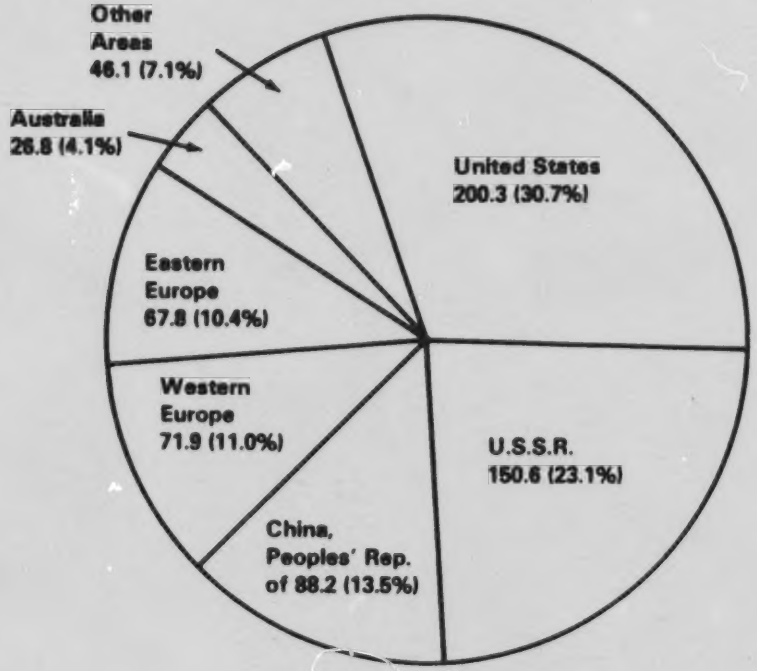


SOURCE:
Adapted from the
Annual Report to Congress
Dept. of Energy, Vol. 2, 1979

ESTIMATED INTERNATIONAL RECOVERABLE RESERVES OF COAL

1974

World Total: 651.7



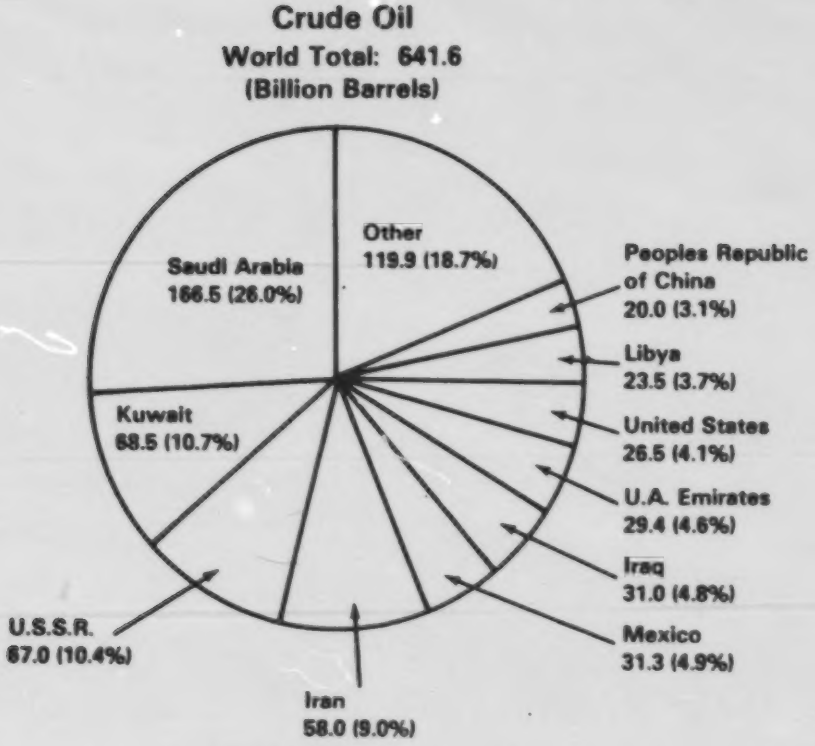
International recoverable reserves of coal in 1974 were estimated at 651.7 billion short tons. The United States ranked first with 200.3 billion short tons, followed by the U.S.S.R. with 150.6 billion short tons, and China with 88.2 billion short tons. Together, these three countries account for two-thirds of the world total recoverable reserves.

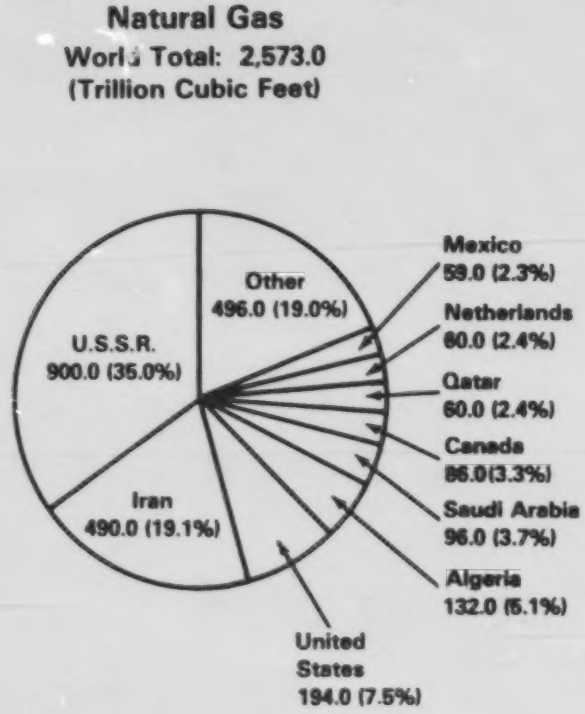
SOURCE: Dept. U.S. Dept. of Energy Annual Report to Congress Vol. 2 — 1979

Energy Activities
Grade 6
Packet "A"
Transparency #2
Activity D, 1.5, pg. 9

ESTIMATED INTERNATIONAL CRUDE OIL AND NATURAL GAS PROVED RESERVES

December 31, 1979





Note: Quantities scaled in proportion to area based on the Btu equivalence; 1 barrel of crude oil equals approximately 5,700 cubic feet of natural gas.

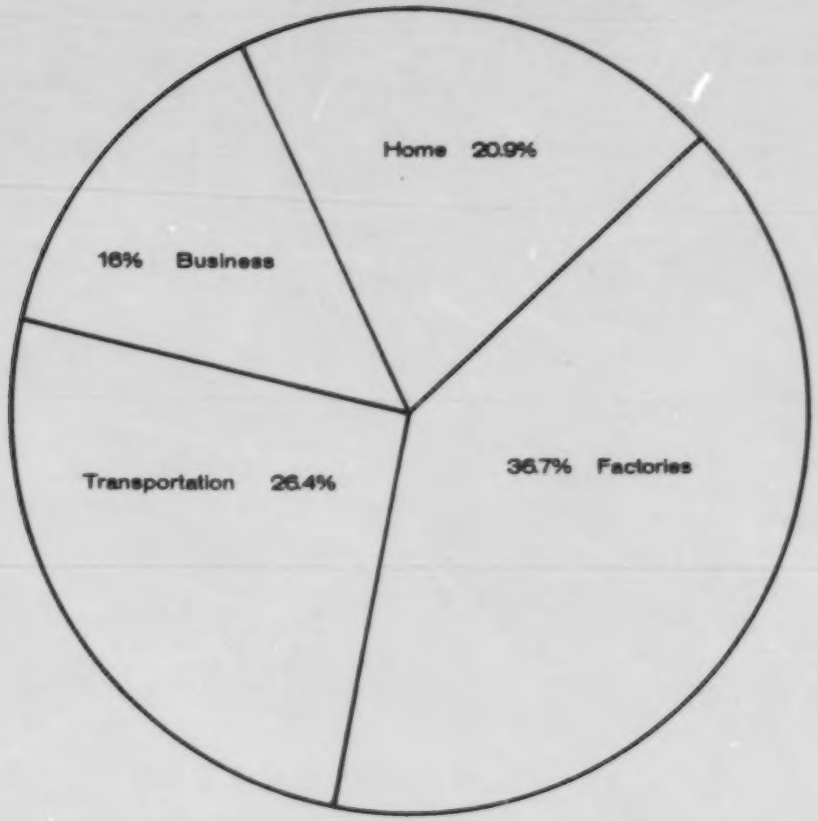
As of December 31, 1979, proved reserves of crude oil were 641.6 billion barrels. Saudi Arabia, with 166.5 billion barrels, was the largest holder of reserves, followed by Kuwait, U.S.S.R., and Iran. Other than these four, no nation maintained more than 5 percent of the world total. The United States ranked eighth with 26.5 billion barrels of proved reserves, 4.1 percent of the world total.

SOURCE: U.S. Dept. of Energy Annual Report to Congress Vol. 2 — 1979

Energy Activities
Grade 6
Packet "A"
Transparency #3
Activity D, 1.5, pg. 9

WAYS THE UNITED STATES USES ITS ENERGY

1978 FIGURES



SOURCE: Adapted from the State Energy Data Report U.S. Dept. of Energy, April, 1980

Energy Activities
Grade 6
Packet "A"
Transparency #4
Activity D, 1.5, pg. 9

STUDENT REPORTS

Choose one of the following men of science who worked on some kind of energy:

Isaac Watt	E. O. Lawrence	Enrico Fermi
Michael Faraday	John Cockcroft	Ernest Rutherford
Albert Einstein	Lise Meitner	Benjamin Franklin

If you know of another one you may use that is not on the list, please check it with your teacher.

Your report should consider the following questions:

a. What was there in the life of the man you have chosen that interested you?

b. For what things did you admire him most?

c. What exactly did he achieve?

d. What difficulties did he have to undergo to achieve his goals?

e. Where did he make his greatest contribution?

f. Who benefited from this contribution?

g. Are the benefits still present today?

VALUE JUDGEMENTS RANK ORDER

Which of the following do you consider to be the most important?
Use the spaces at the bottom, and the scale, to rank the statements.

Scale: 1 = most important
9 = least important

a. Pure water

b. Clean air

c. Lower noise levels

d. Conservation of natural resources

e. Living an environmental life-style

f. Elimination of litter

g. Wise buying practices

h. Use less energy

i. Be aware of the environment

1. _____ 5. _____ 9. _____

2. _____ 6. _____

3. _____ 7. _____

4. _____ 8. _____

VALUES SHEET

Name _____

It is estimated that the aluminum industry uses 7% of the nation's total energy. Recycling of aluminum requires only 5% as much energy as must be used to produce aluminum from its ore.

1. What does this statement say to you?

2. Do you buy soft drinks in bottles or in cans?

3. In what ways do you try to recycle the aluminum cans you buy?

4. How important is it to you to recycle things?

5. If you plan to make any changes in your ways, please say what changes you will make. If you do not intend to make any changes, write "No Changes."

VALUES SHEET

Name _____

A car weighing 5,000 pounds uses over twice as much fuel as one weighing 2,000 pounds. Accessories such as air conditioning and automatic transmission contribute to fuel consumption.

The average car driven at 75 to 80 mph will consume twice as much fuel as the same car driven at 50 mph.

1. How do these two statements make you feel about the size of your family car and the speed at which it is driven?

2. What can you do about the size of your family car?

3. What can you do about the speed at which your family's car is driven?

4. How important is it to you that people drive smaller cars and drive slower?

5. What are some of the other things which could be done to save energy in transportation?

6. What are you going to do to help others realize the problems?

Energy Activities
Grade 6
Packet "A"
Data Sheet #2
Activity A, 2.8, pg. 13

ENJOY THE WILDERNESS!

DON'T POLLUTE!

SAVE MONEY!

CAMPING TRIP

How will you get to the campsite from your home, which is 200 miles away?

What kind of housing will you need on your trip to the campsite?

What type of housing will you have at the campsite?

What will you use for cooking fuel to prepare your meals?

What are the types of activities you will do at camp?

Energy Activities
Grade 6
Packet "A"
Master #10
Activity A, 2.9, pg. 13

ENERGY HABITS

Evaluate your habits. Then make a contract with yourself regarding one of the habits. If you wish, have your family make the contract so everyone will work on it.

1. Avoid buying aerosol cans.
   - dangerous
   - 16% of the cost for the product goes for the container
2. Buy all-aluminum cans.
3. Use and reuse each piece of aluminum foil before recycling it.
4. Buy only returnable bottles and return them.
5. Reuse glass jars.
6. Do not accept plastic bags at the grocery story or at the dry cleaners.
7. Return styrofoam egg and meat containers to the stores where you purchased the items.
8. Do not buy frozen foods in plastic cooking pouches.
9. Take your own shopping bags to the store.
10. Write on both sides of paper.
11. Use cloth napkins, towels.
12. Do not throw away leftovers. Use for lunches or add to pet food.
13. Use cloth handkerchiefs.
14. Reuse wax paper liners in cereal boxes for wrapping other items.
15. Save and bundle newspapers.

ENERGY ALTERNATIVES
OR
FUTURE SOURCES OF ENERGY

Filmstrip #2

#1 Energy demand is outstripping supply. We must face the fact that soon some fuels will be gone. Research must develop efficient and clean sources of energy.

#2 Wind power is one of the world's oldest energy systems and currently is being re-examined for feasibility and efficiency. Wind has been replaced by other sources of energy which are more dependable and more economically reasonable. Wind blows nearly always and nearly everywhere.

#3 The darkest tints on this map indicate where the greatest wind energy potentials are located. These are areas that have powerful winds part of the time. As an example, 2 cities have identical average wind speeds, but City A's winds blow 8.2 mph for half of each day and 14.2 mph for the other half. During their windier half day, City B has as much energy available as City A would have during the whole day. In short, we could say a little more wind means a lot more power.

#4 Experimental wind power machines were built between 1935 and 1955, primarily in Europe, but were discarded, usually for economic reasons.

This Danish Gedser Mill Wind Turbine was developed after World War II. Tied into the existing public utility network, with a 200 kilowatt rated power output at 33.6 mph wind speed, it operated successfully until the early 1960's when the cost of electricity by wind power proved to be twice the equivalent fuel cost of steam.

#5 The world's largest windmill was an experimental wind turbine generator called the Smith-Putnam machine. It was built in 1941 at Grandpa's Knob near Rutland, Vermont. During the 1940's it fed electricity into local power lines, but the project was abandoned in 1945 when one of the eight-ton blades tore loose. These two blades spanned 175 feet and the generator pumped enough power for perhaps 200 homes.

#6 Experimental designs are still being developed. The Energy Research and Development Administration (ERDA) experimental 100-kilowatt propeller type windmill near Sandusky, Ohio, starts to generate electricity in 8 mph winds and reaches full power in 18 mph winds. This huge experimental generator

was designed by National Aeronautics and Space Administration and is mounted on a 100-foot tower. The rotor has two aluminum blades, each 62½ feet long. The system is being tested as a possible prototype for practical commercial machines. The Experimental Wind-Turbine Generator could possibly supply 30 homes with power.

#7 Vertical axis wind turbines are now undergoing tests in Albuquerque, New Mexico. Curved airfoil blades in a vertical position can accept wind from any direction, and rotors at the top and bottom set the turbine in motion even at low wind speeds.

#8 The wind, however, is not the only inexhaustible source of energy available. We also must look to the sun to help solve our energy needs. The sunshine that falls on Connecticut roughly equals the total energy used in all 50 states. Harnessing the sun's energy remains a major problem. However, steps are being taken to overcome this problem. Already the sun's energy has been put to use on a small scale to provide space and hot water heating in homes and buildings all over the world.

Rooftop solar heaters are most commonly used. This solar home in Colorado utilizes a liquid system with panels by Revere Copper.

#9 Solar heating systems require storage for heat collected during sunny days for use at night and in overcast weather. Insulated tanks for heat storage can be placed above or below ground and can store heat in water or in rock beds.

The Donald Suttons of Ogden, Iowa, utilize a rock storage bed.

#10 The Living History Farms near Des Moines, Iowa, will be constructing a single-family farm using the sun for its power and solar pond for storing heat.

#11 The sun's light may be converted directly into electric power by semi-conducting devices called photovoltaic cells.

#12 People also have begun to take an interest in resource recovery as an energy source. One of the most advanced and complete resource recovery systems has been built by the city of Ames, Iowa.

#13 In 1975, the Ames Solid Waste Recovery Plant began using combustible refuse in the coal-fired boilers at the city-owned electrical power plant.

#14 Solid waste comes from Ames, Iowa State University, and several other communities. The wastes pass through two stages where they are first shredded to one-half inch size.

#15 Ferrous metals, aluminum, glass, sand and grit are removed. The wastes which remain are taken by conveyor to the power plant to be used.

#16 Nuclear power plants burn a fuel just as conventional power plants do. The difference is in the fuel used. Nuclear power plants commonly use uranium-235, which occurs in nature. One piece of uranium fuel the size of a golf ball has the energy equivalent of 168,000 gallons of oil. The only commercial nuclear energy generating facility operating in Iowa is the Duane Arnold Energy Center near Palo, Iowa. This plant, along with others, is based on uranium fission which is the splitting of the nuclei.

#17 The nuclear fuel cycle begins with the uranium being mined and the ore milled to produce a concentrate. A conversion plant purifies the uranium and converts it to uranium hexafluoride (UF_6). At the enrichment plant the gaseous UF_6 is enriched and stored. The enriched UF_6 is converted into uranium dioxide, made into pellets, loaned into tubing, and made into fuel element bundles. These go to the nuclear power reactor and are used to produce electricity. Spent fuel is removed and stored in cooling tanks before being shipped in heavy lead casks. Plutonium is stored for possible future use as a fuel. Radioactive wastes will be shipped to a Federal Waste Repository and low-level wastes are buried.

Another type of nuclear energy - fusion - is being demonstrated and tested, but it has not been developed sufficiently for commercial application. Fusion is a process of combining the nuclei of light elements to produce heat. Its most important feature is that its fuel is derived from water.

#18 The rise and fall of the tides rotates turbines to generate electricity. With the use of gates and pool areas, water can be held in readiness for a peak demand time. In the U.S. there are a number of possible sites, varying in potential of perhaps 2,000 to 20,000,000 kilowatts each. The Pasamaquadi Tidal Power Project off the Maine Coast has been in the discussion stages since the 1920's, but no actual construction has taken place due to high costs of development and alternative supplies which are readily available. The only large-scale tidal project in actual operation is one on the Rance River in France with a capacity of 240,000 kilowatts.

#19 One energy source we cannot overlook is geothermal power, the heat from within the earth. Geothermal power is not expected to become a major source of energy in the near future, but it is not to be pushed aside.

#20 At the present time electrical power is being produced at the Geysers in northern California. Steam is collected, filtered and passed through turbines that drive electric generators. Geothermal energy also may be used for household heating and industrial processes.

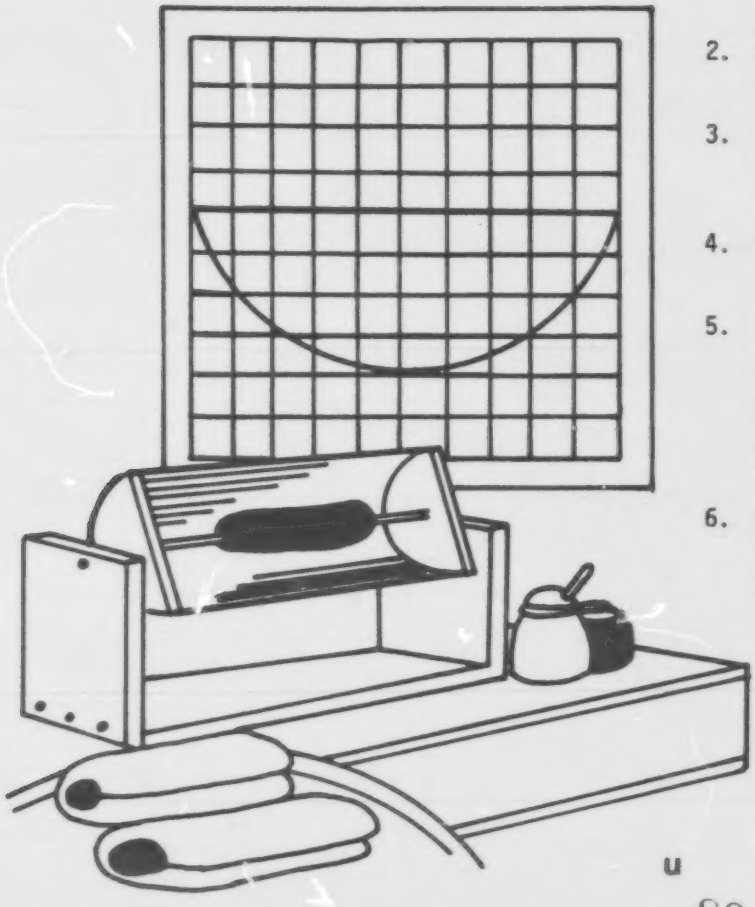
It is essential that we continue to explore new methods so that our energy needs will be met without damaging the environment.

Energy Activities
Grade 6
Packet "B"
Experiment Sheet #1
Activity F, 1.1, pg. 20

SOLAR HOT DOG COOKER

Experiment taken from Energy Conservation: Experiments You Can Do, Thomas Alva Edison Foundation, Inc., 1974.

Materials: piece of 1 x 8 lumber 4 ft. long, 1 ft. wide by 2 ft. long sheet of aluminum (the kind sold in hardware and lumber stores), 2 four-inch nails, handful of short nails, two wood screws about 2 inches long, two metal washers to fit the screws, pad of steel wool, tube of household cement, shiny aluminum foil, large piece of brown wrapping paper and pencil, yardstick or ruler, hot dogs, tin snips.



1. Draw a grid of one-inch squares on the wrapping paper. The grid should contain 100 squares and measure 10 inches by 10 inches.
2. Draw on the grid the pattern and be ACCURATE!
3. Cut out the pattern, lay it on the piece of wood next to one end and trace it.
4. Make a second one just like the first.
5. Use a wood saw to cut out the two side pieces. Then cut a 12 1/4 inch piece of wood for the base and two 8 1/4 inch pieces of wood for the side supports.
6. Nail the piece of aluminum to the side panels to make a type of aluminum-bottomed "canoe." Cut off the excess metal with tin snips. ⇨

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7. Use the steel wool to polish the inner surface of the aluminum and wipe off. Apply a layer of household cement to the surface and cover with a piece of aluminum foil cut to fit inside the "canoe." (shiny side out!)

8. Look at the sketch. Drill one hole in the center of the upper portion of each side panel.

9. Push the long nails into the holes and secure with a small amount of cement. Polish the nails with steel wool and rinse with water.

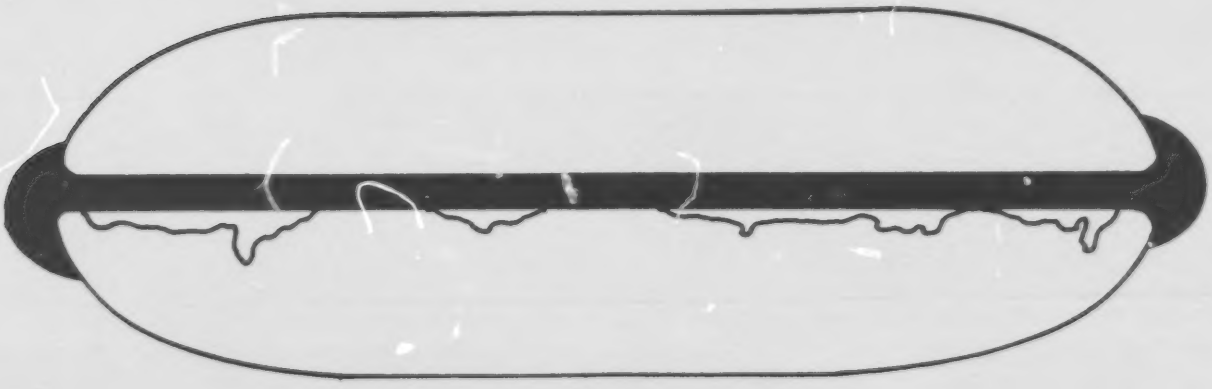
10. Nail the base and side supports together.

11. Drill a hole near the top of each side support.

12. Use the wood screws and washers to mount the "canoe" on the support stand.

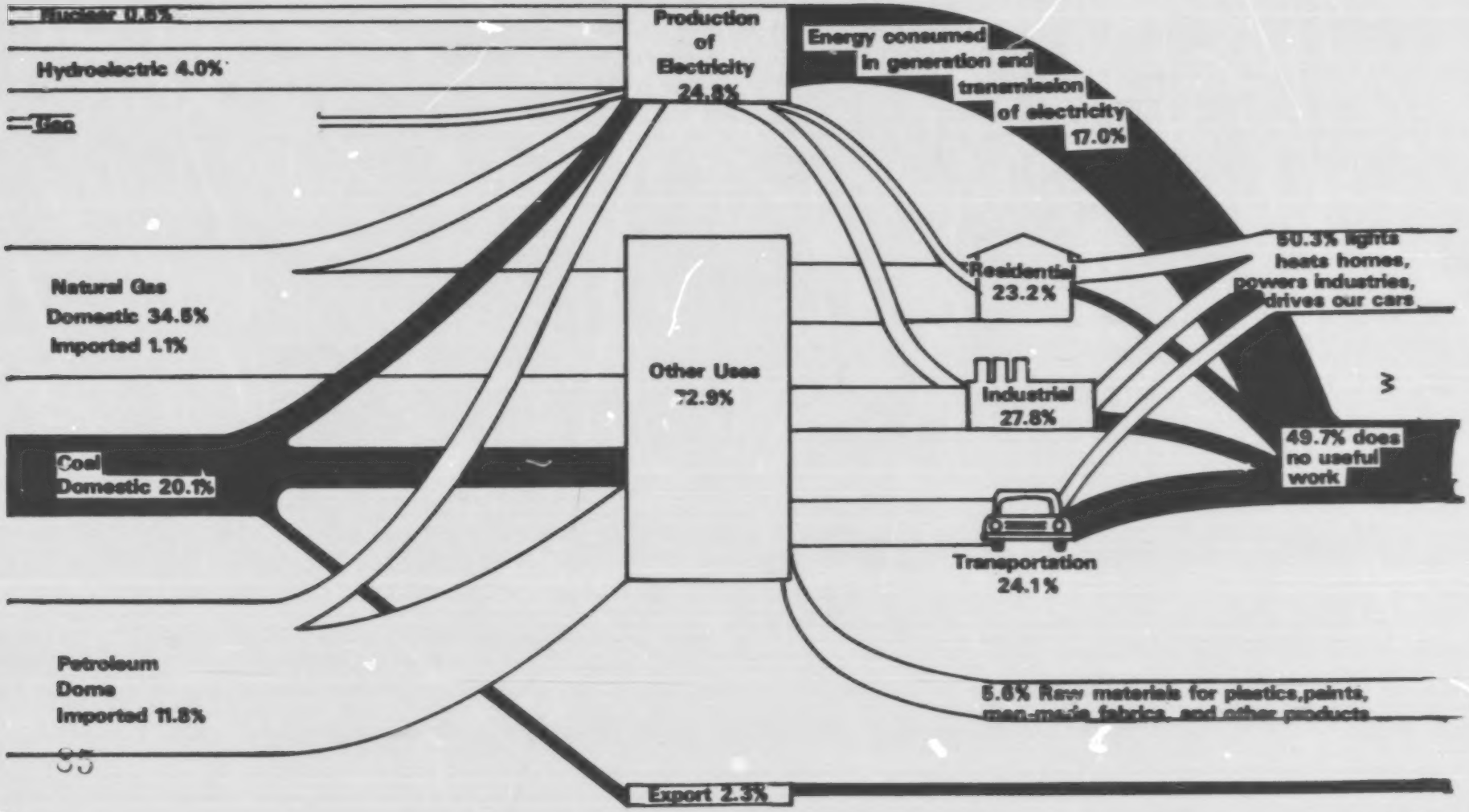
13. Skewer a hot dog on the two long nails, point the cooker toward the sun. It takes a minute or two of strong sunlight to prepare the hot dog.

14. Use a fork to remove the hot dog as the nails get hot.

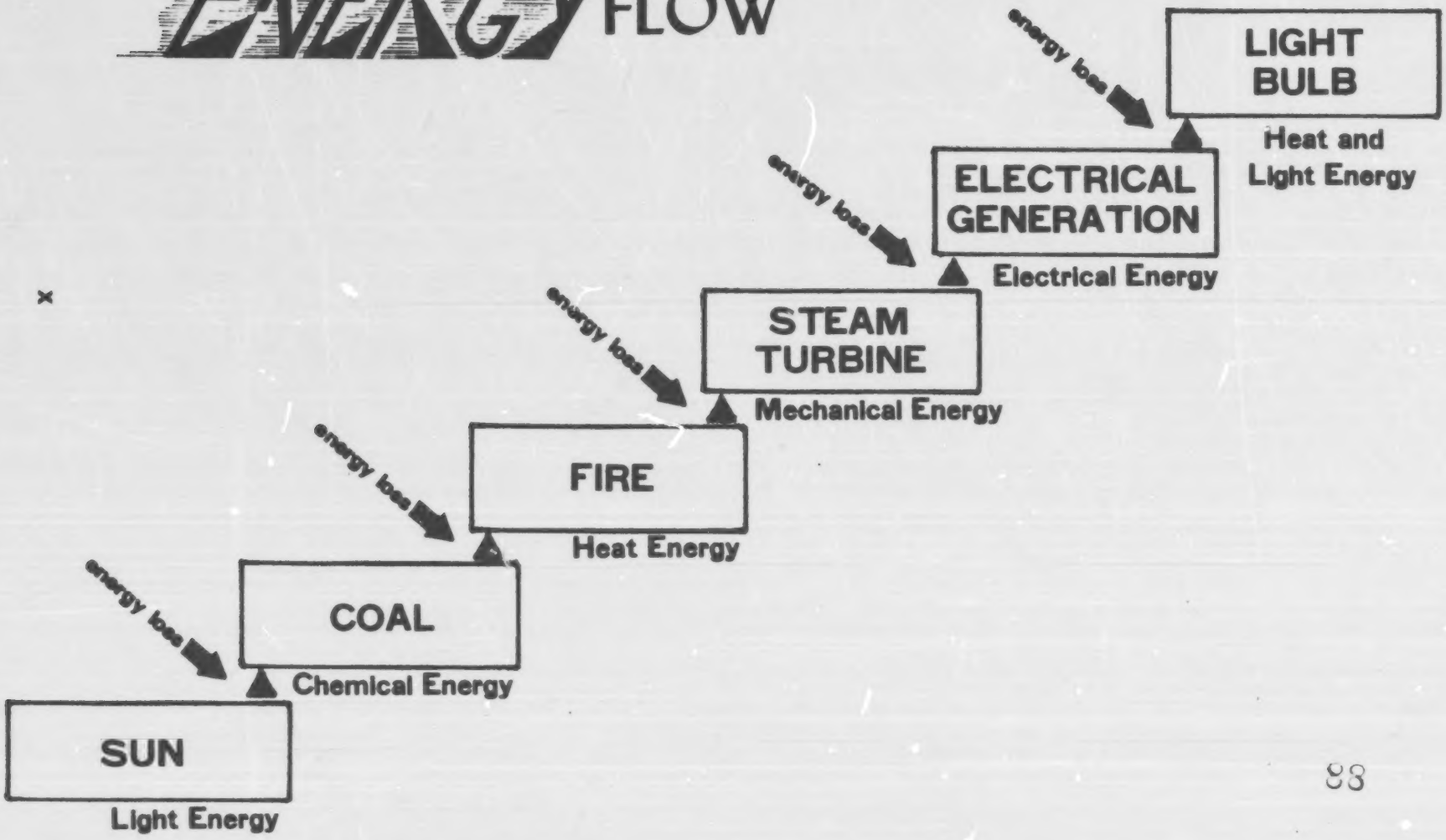


Energy Activities
Grade 6
Packet "B"
Transparency #1
Activity A, 1.2, pg. 21

U.S. ENERGY FLOW CHART



ENERGY FLOW


LIGHT BULB
Heat and Light Energy
energy loss
ELECTRICAL GENERATION
Electrical Energy
energy loss
STEAM TURBINE
Mechanical Energy
energy loss
FIRE
Heat Energy
energy loss
COAL
Chemical Energy
energy loss
SUN
Light Energy

Energy Activities
Grade 6
Packet "B"
Transparency #3
Activity C, 1.2, pg. 21

Do Returnable Bottles $ave

The purchase of a six-pack of soft drinks in returnable bottles instead of no-deposit no-return containers will save the energy equivalent of .25 liters of gasoline. The saving of 0.25 liters of gasoline can take the average family car about 2 1/2 miles. In addition, when the empty bottles are returned for a 30-cent deposit, the six-pack purchase will have cost 18 cents less than for throw-aways.

1. If each family in the class purchased one or two six-packs of returnable bottles each week for one year, how much energy in gasoline will be saved?

2. Using the figure from #1, how many miles of automobile travel are possible with the energy which is saved?

3. How much money is saved?

4. Why do you think so many people still buy beverages in throw-away containers?

5. What do you think the government or people should do about this matter? What will you do?

Energy Activities
Grade 6
Packet "B"
Data Sheet #1
Activity D, 1.2, pg. 2

MY ENERGY INVENTORY

Name _____

Things often wasted in my home	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
Pencils							
Paper Towels							

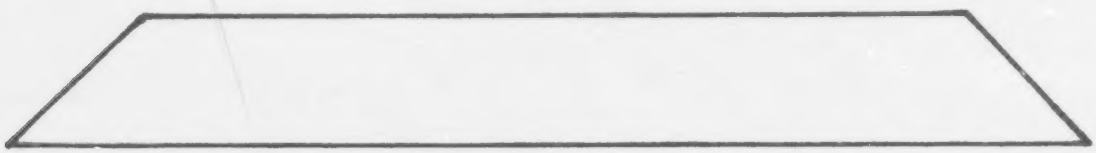
Energy Activities
Grade 6
Packet "B"
Master #1
Activity E, 1.2, pg. 22

RECYCLING PAPER

Materials: newspapers, mixing bowl, egg beater, wood block, window screen (3-4 inches square), plastic sandwich bag, wallpaper paste or corn starch, water, tablespoon

Directions:

1. Fill the bowl one-fourth full of water.
2. Tear one half of a newspaper page into pieces and put into the bowl to soak for an hour.
3. After it is soaked, beat it with an egg beater until creamy.
4. Dissolve two heaping tablespoons of the wallpaper paste or corn starch in a pint of water, then pour into the bowl and stir.
5. Hold the piece of window screen flat and lower it into the pulp in the bowl. Repeat this until you have a layer of pulp about one-tenth of an inch thick.
6. Set the screen on a newspaper and place the plastic sandwich bag over it. Press down with the wood block--first gently then with more pressure.
7. Allow the fibers to dry for about 24 hours. Then peel the fiber, then the paper from the screen.



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INVENTIONS AND ECONOMY

Choose another student as your partner to research the life and invention of one of the following men. You may wish to choose one not mentioned below.

Eli Whitney
Cyrus McCormick
Thomas Edison
Alexander Graham Bell
Andrew Carnegie
Henry Ford
Wright Brothers

One student describes the personal life of the inventor

OBSTACLES

DISCOVERIES

EFFECTS ON HIS LIFE

One student describes how WORK, TRAVEL, COMMUNICATION, INDUSTRY were changed by the invention. Include the products and conveniences which were a result of the invention.

CAN YOU DO WITHOUT ELECTRICITY

Which of the following could you do in your home without electricity? Circle those you feel you could do adequately. Be ready to explain how you would do them without electricity.

1. cooking
2. washing dishes
3. drying clothes
4. washing clothes
5. opening cans
6. storing food in summer
7. storing food in winter
8. lighting
9. keeping warm in the winter
10. keeping cool in the summer

Energy Activities
Grade 6
Packet "B"
Master #4
Activity A, 2.6, pg. 25

ALTERNATIVES CHART

Alternative	I'll try it	I'll consider it	I won't try it

dd

Energy Activities
Grade 6
Packet "B"
Master #5
Activity B, 2.6, pg. 26

CONSEQUENCES GRID

Alternative # 1	Alternative # 2	Alternative # 3

ee

Energy Activities
Grade 6
Packet "B"
Transparency #4
Activity C, 2.9
pg. 27

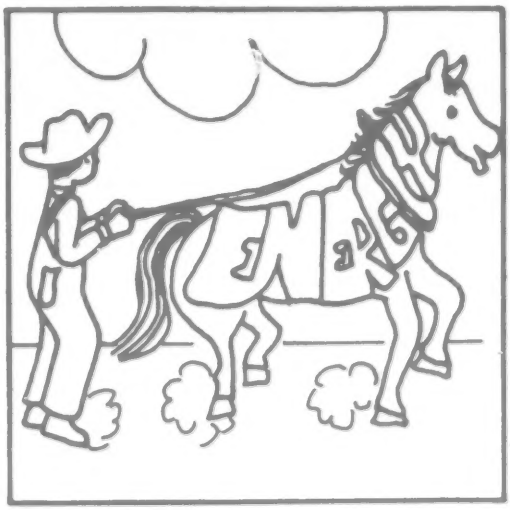
ATTITUDES TOWARD ENERGY

From A Teacher's Handbook on Energy, Colorado

No need to limit consumption of energy.

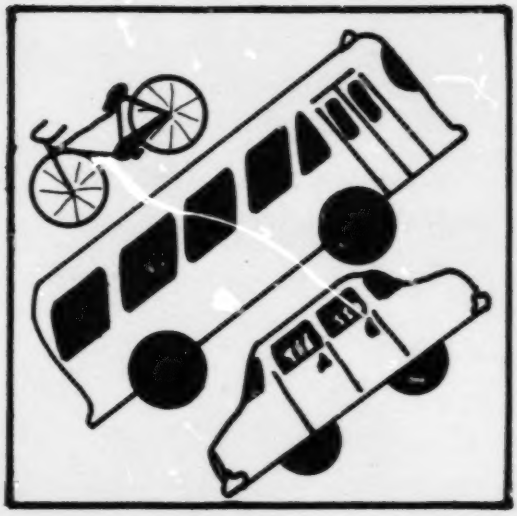
The quality of the natural environment is not affected by energy consumption.

If we cut back our energy consumption, we would be back to "cave man" days.

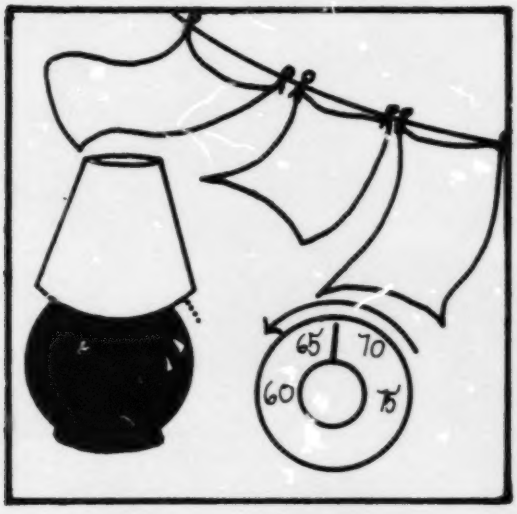


Man has the right to harness all the energy his technology permits. He has a right to use it for his own wants and needs.

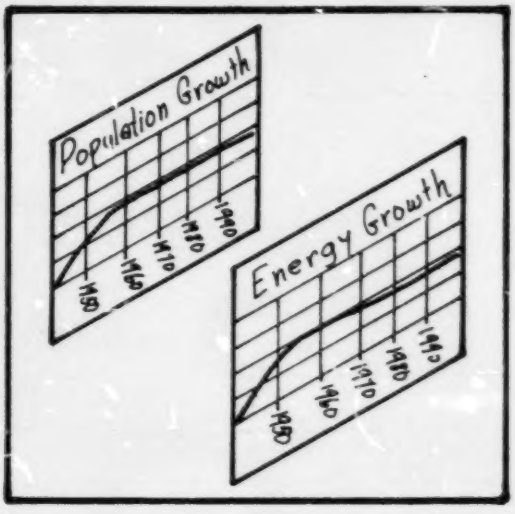
Energy is limited. We should use it carefully.



Energy consumption does affect the quality of the natural environment. We should be aware of ways to eliminate some energy use.



We can reduce energy consumption without returning to "caveman" days.



Man can live better with his environment if he conserves energy use and limits population.

Energy Activities
Grade 6
Packet "B"
Transparency #6
ctivity C, 2.9, pg. 27

There is nothing wrong with the people of the United States. They provide 6% of the world's population but use 30-40% of the world's natural resources.

When you have extensive reserves of an energy source, harness it without reservation to help solve any energy shortage.

The quality of life in our generation is more important than generations of the future.

Question to ask yourself about use of energy: Will development provide me with a higher standard of living?

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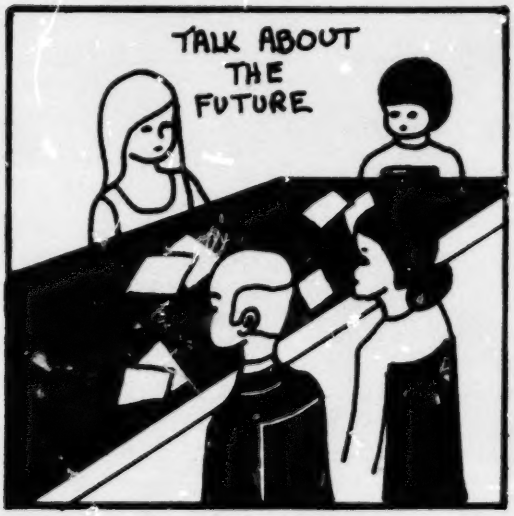
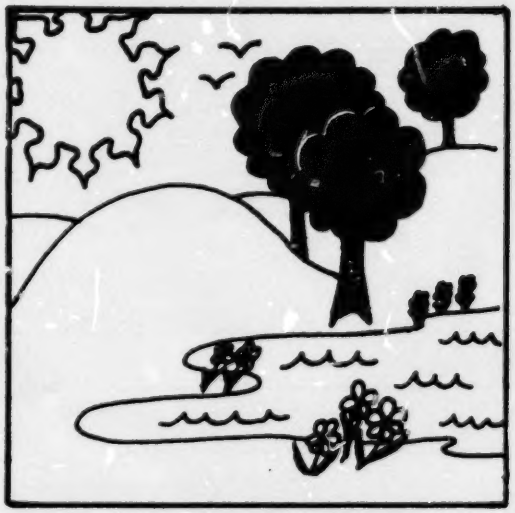
Energy Activities
Grade 6
Packet "B"
Transparency #7
Activity C, 2.9, pg. 27

The people in the United States need to examine the world's picture of energy and need to make some changes in their use of energy.

Environmental impact of each energy resource development should be carefully considered.



We should think about future generations when we consider present use of resources.



The need for preserving clean air, clean water, and a healthy environment is more important than increasing your standard of living.